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NOTES AND COMMENTS

Australian Results, 1957.

The 1957 season produced the second highest sugar output on record, being exceeded only by the 1954 season's outturn. Production, estimated in the 50th Annual Report of the Australian Sugar Producers' Association Ltd., amounted to 1,290,000 tons of 94 N.T. sugar including 1,254,000 tons from Queensland and 36,000 tons from New South Wales. A much better season was enjoyed by Northern Queensland than in the 1954–1956 crops, but South Queensland suffered severely from prolonged drought. Export sugar from the 1957 season is estimated to be 745,000 tons, 94 N.T., valued at about £A33 million, nett of charges for sea transport, etc.

The 1957 season compared well with previous seasons, except for most areas in South Queensland, so far as cane and sugar yields are concerned. Cane crushed, at 8,943,524 tons, represented a yield of 24·54 tons per acre. Conditions were generally favourable to sugar content and one ton of sugar was produced from 7·12 tons of cane compared with averages of 7·41 tons for the period 1952–57 and 7·35 tons for 1948–57. With a cane tonnage 35,000 tons less than in 1956, over 80,000 more tons of sugar were produced in 1957. While climatic factors were the outstanding influence in this improvement, nature was helped in three ways: better supply of labour for harvesting, higher crushing rates by the mills, and the drive for supply of cane to the mills in a cleaner condition.

For the first time, over 400,000 tons of cane were crushed by the Queensland mills in a week and this was achieved for a total of ten weeks, nine of them consecutive. The highest weekly crushing was 429,390 tons. The double-tandem Victoria mill reached a record weekly crushing of 31,710 tons.

About 30% of the Queensland cane crop was mechanically loaded, while only 107,000 tons were cut mechanically compared with 182,000 tons in the previous year. In 1956, however, over 80% of this tonnage was in South Queensland where the crop was seriously reduced in 1957. A J. & L. harvester was imported from Louisiana in October and underwent initial trials at Mossman. The Mechanical Harvesting Committee of the sugar organisations considers that the results were pleasing, and some modifications which proved necessary are to be made and the machine tested in 1958.

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The Sugar Industry in Pakistan.

With a view to examining the various problems concerning the sugar industry in Pakistan, the Central Government has set up a Sugar Commission with the following terms of reference :

(i) Review of present acreage, production of cane, recovery percentage and manufacturing capacity of mills with actual turnover.

(ii) Economics of the production of refined sugar in Pakistan as compared to that in major sugar producing countries.

(iii) Future expansion of the industry, keeping in view the cost of refined sugar to consumer and expenditure on foreign exchange either on the import of machinery or refined sugar.

(iv) Economics of gur making and khandsari as compared to factory produced refined sugar.

(v) Possibility of increasing the production of beet sugar.

(vi) Use of factory molasses for the production of glycerine, power alcohol, etc.

(vii) Recommendations for future expansion of area and production of sugar.

The commission includes representatives of the Depts. of Agriculture, cane growers and the sugar industries of both East and West Pakistan ; representatives of the Planning Board and the Pakistan Industrial Development Corporation and will be presided over by MIAN AFZAL HUSSAIN, Vice-Chancellor of Punjab University, with a representative of the Ministry of Food as Secretary.

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Phillipines Sugar Industry, 1957[1].

The 25 factories that operated during the 1956–57 crop milled a total of 9,018,147 tons of cane, resulting

[1] F. O. LICHT, *International Sugar Report*, 1958, **90**, (Supp. 12) 13.

in 1,037,116 tons of sugar of 97·46 average polarization. This is 94·86% of their total estimated production and 88·71% of their total quota. Production for the 1956/57 crop was 6·28% less than that of the 1955/56 crop and was 145,801 short tons less than the quota requirements of 1,289,007 short tons.

The higher quality of cane milled during the 1956/57 crop indicated that consistent efforts are being made to improve the yield and quality of the cane as the rendement has been on the up-grade steadily since the 1951/52 crop. With the exception of Cebu and Mindoro the Islands had higher quality canes than the previous crop. The quality ratio for the 1956/57 crop was 7·81 against 8·01 for 1955/56.

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Hawaiian Strike Ended.

Agreement was reached between the ILWU and managements of the sugar plantations on 28th May whereby the men were able to go back into the fields on the 30th to re-start the irrigation and field work pending the settlement of all the issues involved in the disagreement. The formula evolved is based on the Governor of Hawaii's recommendation of a wage increase of 16 cents per hour for a contract to terminate on 31st January 1961, together with further benefits. Negotiations have been apparently successful to some extent at least, as harvesting and other work is reported to have started on 9th June.

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Mauritius Sugar Crop 1957.[1]

Twenty-six factories were in operation during the crop. Crushing started on the 2nd July 1957 and finished on the 17th December, a season of 105 days compared with 109 in 1956. The sugar produced totalled 561,602 metric tons (572,512 tons in 1956) from 4,343,898 tons of cane (4,421,427) with a recovery of 12·93% (12·95% in 1956), while total losses were 1·86% on cane (1·87%). Average polarization of the sugar produced was 98·5 (98·6 in 1956) while the average crushing rate was 76·4 t.c.h. (74·5).

Local sales in Mauritius and the Seychelles up to 31st May totalled 19,928 tons, and total exports were 537,620 metric tons, leaving a stock in hand of 4054 tons. The exports were destined as indicated below:

U.K.	370,699
Canada	88,093
Japan	24,624
Malaya	3,149
Singapore	610
Hong Kong	12,787
Iran	19,697
Lebanon	1,016
Syria	9,144
Ceylon	7,801
	537,620

South African Campaign 1958/59.[2]

The 1958/59 campaign is now well under way, according to the South African Sugar Association, and preliminary forecasts of cane and sugar production have been made. Not taking into consideration the small temporary mill which has been erected in Swaziland and which is expected to produce some 12,000 to 16,000 tons of sugar, the total cane production is forecast at this stage at 9,461,846 short tons, whilst sugar output is put at the record figure of 1,008,200 tons. Even this figure is now thought to be on the low side and one mill has already stated its intention of increasing its original estimate by 15,000 tons.

Total domestic requirements in the year May/April, 1957/58 amounted to 726,997 short tons, an increase on the previous season of 54,471 tons. This season an allocation of 755,100 tons is being made in order to allow for increasing consumption.

The crop is said to be in very good condition and with temperatures above average and very heavy rain in all areas excellent progress is being made.

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U.S. Sugar Quotas, 1958.

The U.S. Dept. of Agriculture announced on 19th May that the estimate of domestic sugar requirements (quota) was being increased from 8,800,000 short tons, raw value, to 8,900,000 tons. The Dept. stated that this action was due to the fact that the harvesting of sugar cane in the Caribbean would soon be completed and the period of heavy sugar consumption was approaching. The duty-paid price for raw sugar at New York had increased from 6·00 to 6·30 cents per lb between mid-March and 13th May. Total distribution in 1957 was 8,735,000 tons and distribution up to 10th May 1958 was approximately 150,000 tons higher than in the comparable period of 1957.

On 23rd May, the Dept. announced additional quota deficits of 100,000 tons and 50,000 tons for Hawaii and Puerto Rico which were prorated to the mainland areas and Cuba. With re-allocations of deficits and the overall increase, Cuba's quota has increased by no less than 324,049 short tons in the short period from 23rd April when the first deficits were announced.

Details of individual quotas as adjusted are as follows:

Raw sugar value	*Short tons*	*Long tons*
Domestic Beet	2,184,484	1,950,432
Mainland Cane	672,186	600,166
Hawaii	765,000	683,036
Puerto Rico	815,000	727,679
Virgin Islands	15,371	13,724
Philippines	980,000	875,000
Cuba	3,266,164	2,916,218
Other Foreign Countries	201,795	180,174
	8,900,000	7,946,429

[1] *Mauritius Sugar News Bulletin*, 1958, (80).
[2] C. Czarnikow Ltd., *Sugar Review*, 1958, (358), 105.

PROFIT SHARING AND CO-PARTNERSHIP

THERE can be little doubt that much of the social unrest that characterizes the present age is due to lack of adjustment in the speed of mental response to changing circumstances. It has always been so ; when subsistence agriculture, based on the family as the social unit, ceased to satisfy man's growing ambition, the simplest response was to employ extra hands to provide the additional productive capacity and it was only natural that, man being in general a selfish animal, he should seek a form of labour which imposed on himself the minimum of cost. Thus arose slavery, on which the whole classical social organization depended ; slavery survived until relatively modern times even in civilized countries and is still in operation here and there. Abolition of slavery coincided in general with the industrial revolution and it is extremely doubtful whether the conditions of employment of the industrial "hands" in those early days were not more abject than those of open slavery. There were a few among the employers, such as ROBERT OWEN, who had vision and attempted to bring about improvement but they were too few to influence the general employer-attitude, and labour was too backward to appreciate their efforts. In this race between a change in mental outlook in the employer and a growing awareness of power through organization of the employee, it was the latter that won and there has, unfortunately, arisen an antipathy between employer and employee which all efforts so far have failed to break down.

In the industrial field, in which the need for finding a solution is most urgent, the race is neck and neck. Where vast power is accumulated, there are always forthcoming men ready to grasp and abuse it ; and industrial labour has reached that stage. On the other side, there has been an awakening to the danger on the part of employers ; there is a movement, already reaching large proportions, to find a means of ensuring that labour shall in some way share in the fortune of the particular industrial enterprise in which it is employed. Both in Britain and the U.S.A. influential organizations are in being seeking the answer. The problem they face is great, both because of the slow receptiveness to novel ideas and because the varied nature of industrial enterprise prevents standardization. Proposals range from profit-sharing, under which part of the annual profits are set aside for division among the employees, through partial co-partnership, with the incentive in the form of bonus shares usually with restrictions on methods of disposal, to full co-partnership, with elected representatives of the employees holding directorships.

Co-partnership, as it has evolved, is an industrial movement ; that is evident from the title of the British organization, The Industrial Co-partnership Association. This limitation is curious because, in fact, co-partnership principles are far more readily applicable in agriculture than in industry : and for this reason. In the large industrial organizations of the present day—and these set the tone to industrial relations—any close personal contact between the chief directives and the employee is ruled out. In agriculture, this is not the case ; an agricultural unit must be very large before the plantation or estate manager does not establish a greater or less personal contact with all his labour during the course of his almost daily round. It is the personal touch which is so important, for it acts as a prophylactic and not as a remedy.

Agriculture, and particularly tropical agrculture is not without its examples of the application of co-partnership principles, though, in the general backwardness of tropical labour, little more than profit sharing has been attempted and recourse has been made to that other psychological factor so productive of harmony, the sense of ownership of a plot of soil. The vast scheme of irrigation and cotton growing in the Sudan Gezira is, perhaps, the first example of the application of the two principles and its success was, from the first, complete. The second example is provided by the sugar industry, when the cutting off of indentured Indian labour in 1919 for Fiji created a labour shortage in those Islands. Here, initially, the situation was met by an appeal to the psychological factor of the sense of ownership ; only later, as the result of soaring prices during the war, was profit-sharing, in the form of a sliding scale for cane, adopted. Again, the success of the dual principle was unqualified.

In view of these two outstanding examples of the advantage of a form of co-partnership, it is difficult to understand why the system remained completely ignored for so many years. The East African groundnut scheme offered a splendid opportunity for adding a third example, but the planners of that scheme had failed to learn the lesson. It was the sugar industry of British Guiana which was to provide the next example, and the development will be watched with interest. Here, again, the psychological factor is an essential feature of the scheme. The West Indies is now providing yet another example in a scheme recently introduced by the Caroni Company.

The Caroni Estate is worked on a plantation basis with paid labour and the scheme now being adopted is on a simple profit-sharing basis, ignoring the psychological factor. Briefly, it establishes a Profit Sharing Fund into which is paid B.W.I. $5 for every ton of sugar produced over 65,000 tons plus B.W.I. $7·5 for every B.W.I. $100 by which the net profit, after deduction of tax, exceeds B.W.I.$720,000. The scheme applies only to wage-earning employees ; eligibility to be a recipient under the scheme is defined in some detail and the eligible employees are divided into three grades and receive respectively one full unit, eight-tenths and four-tenths of a unit each. On presentation of the audited accounts the sum credited to the fund will be divided by the sum of the units

[1] *I.S.J.*, 1957, **59**, 173.

earned, the respective fractions be paid out and any balance carried forward. The scheme is a cautious approach to the solution of the growing problem of labour shortage, but is none the less welcome on that account. It is only by trial and error that the final answer will be found ; and it is an answer which will probably differ according to local circumstances.

H.M.-L.

SUGAR CANE RESEARCH AND DEVELOPMENT IN INDIA

THIRD ALL-INDIA CONFERENCE OF SUGAR CANE RESEARCH AND DEVELOPMENT WORKERS, 1957

THE main Presidential address to this Conference by T. C. PURI, reported in the *Indian J. Sugarcane Research and Development*,[1] covers a general historical review of the Indian sugar industry in the modern sense of factory production—for sugar cane has been grown from time immemorial in the country. The big development, in this sense, dates from 1930–31 when fiscal protection was granted. Since then progress, in one direction, has been rapid; from a heavy importer, India has become an exporter of white sugar. In another direction, progress has been far less satisfactory; yields, though showing considerable increase on past standards, remain very low, though the potentialities are there. Thus in Bihar, in which is situated Pusa where the Conference was held, the average yield per acre is only 18·8 tons per acre, though yields as high as over 100 tons have been obtained. The average all-India yield is even lower, at 14 tons, yet records occur of 127 tons in Bombay, 60 tons in Uttar Pradesh and 94 tons in Madras. That is the challenge to those concerned with the development of the sugar cane agriculture. The address concludes with a brief account of the major lines on which improvement is being sought.

N. L. DUTT, Director of the Sugar Cane Breeding Institute, Coimbatore, took as the thesis of his Presidential address to the Sugar Cane Breeding and Botany Section, the "Reorientation of the Breeding Programme at Coimbatore". Breeding work in the past has largely consisted in recombination among the many proven varieties. It is a method that, in time, must lead to a maximum utilization of gene recombinations—such, it will be remembered, was the case in the West Indies in the early days when crossing was confined to "noble" varieties and the appearance of a superior variety became rarer and rarer—and not the least essential is a continued search for a source of new genes. Coimbatore, as the site for one of the world collections of sugar cane varieties and their relatives, is well situated in this matter and the importations of *officinarum* stock has already gone some way to overcome a principal difficulty in the general loss of vegetative vigour in propagation and low flowering propensity of the existing *officinarum* stock.

The question of inbreeding, its advantages and limitations, is then discussed in some detail. The long-term aspect of building up breeding stock for the future must be kept in view and the underlying principle here, it is suggested, should be that if, for instance, a *spontaneum* requires to be back-crossed to *officinarum* to the F_n stage to produce progeny of commercial acceptability, then seedlings of the F_{n-1} stage should be retained as potential breeding material.

Addressing the Sugar Cane Development Section, R. D. REGE offered a critique of the lines on which development work was proceeding. His emphasis is on the earlier noted fact that increased total production is almost entirely due to increased acreage—53% in the last 25 years—with correspondingly small increase in yield. He holds, further, that too great an emphasis is laid on yield of cane regardless of quality, and he suggests that foliar diagnosis should become an accepted standard practice particularly as a guard against the excessive use of nitrogenous fertilizers which so readily stimulate yield at the expense of quality. In this matter, as in that of crop protection against pests and diseases, the greatest handicap lies in the multitude of small growers; for this reason the Pests and Diseases Acts which are on the Statute Book of several States are, to a large extent, dead letters. Co-operation, such as that which has proved so successful in eliminating disease in Queensland, is suggested as the most promising line for improvement.

Agro-biological Research, the subject of K. L. KHANNA'S address to the Agronomy and Physiology Section, covers a very wide field, but its main emphasis is on the running out of varieties such as that of Co 419 which in South India has shown signs of a virus infection, and he stresses the need for a varietal selection based on reaction to adverse conditions. Cultural developments are dealt with at some length and the trend, even in northern India, to autumn planting and, in the tropical belt, to the adoption of an *adsali* (18 month) in place of an *eksali* (12 month) crop system is noted.

The part to be played by soil studies in the development plan is the subject of the address of B. K. MUKERJI to the Chemistry and Soil Section. He, again, stresses the relative failure to secure increased yield and quality. The role of trace elements is one

[1] 1958, **2**, 94–124.

of the items in the soil survey programme. Fertilizer recommendations, it is admitted, are somewhat empirical and plant analysis, together with the use of radio-isotopes, is suggested as a basis for improvement.

In his address to the Entomology Section, K. B. LAL, in the course of a general discussion of pests and measures for their control, notes the increasing incidence of certain of the common pests. Mechanical methods of control, such as collection of egg masses, are becoming impractical and a growing reliance has to be placed on such methods as biological control and the use of insecticides applied by aeroplane.

The Presidential Address to the Pathology Section by B. L. CHONA is devoted to "Red Rot and its Control". Accounts are given of its history, modes of infection, varietal resistance and so on; in connexion with the last an added difficulty is that *C. falcatum* is a complex of several strains of differing pathogenicity. An operational control campaign is outlined in an appendix.

H. M.-L.

RESEARCH AND THE SUGAR CANE INDUSTRY

NO apology appears necessary for a further and more detailed consideration of the address delivered by Sir JOHN SAINT to the assembled Sugar Technologists of the British West Indies[1], for the matter he considered is of unusual and general interest. The subject he discussed is the nature of the organization which will best ensure that the results of research are applied in practice with the minimum delay. In the case of the cane sugar industry, the field covered by research is enormous and very diverse, extending as it does from the cultural methods employed in the field and the breeding of varieties, through problems of factory efficiency to marketing of its main product, sugar, and, of growing importance, of a large number of by-products.

Much of the Address is devoted to a description of the activities of the large American corporations under what is termed C.C.D. (Commercial Chemical Development), activities which embrace, in the sugar industry, all processes from the entry of the cane into the factory. Of any corresponding organization for the West Indian Sugar Industry the small sugar factory at the Imperial College in Trinidad must, it is recognized, form an integral part, for it is the connecting link, the pilot plant, between laboratory research and commercial adoptation. It is pointed out that, in the West Indies, the major difficulty lies between that pilot stage and commercial adoption, since the factory staffs during the crushing season are too engrossed in day-to-day routine to fill the gap. It is here that, in his view, C.C.D. experience may help.

The problem in its agricultural aspect differs materially from that presented by the factory and subsequently, and is discussed in greater brevity. This problem, in its simplest form, is seen in process of solution in the realm of varietal introduction and is well illustrated by the B.W.I. Central Sugar Cane Breeding Station, which carries out the breeding programme and makes preliminary selections, passing these on for final selection locally. It is an adequate system where cane is grown on a plantation basis, but requires an intermediate agency where a purely peasant system prevails.

The problem becomes much more complex when what may be conveniently termed the cultural aspects, in the widest sense of that adjective, are considered ; it becomes even more complex when the economic aspects come to be included. In this connexion attention is drawn to the National Advisory Service as organized in England after the last war, but without any clear indication as to whether it is offered as a solution of the situation presented by the cane industry. A more detailed reference to that Service will bring out several pertinent considerations.

In the first place, there is a vast difference between the two agricultural systems, that of British agriculture and that of cane growing. The latter, for the most part, falls into two sharply divided groups, the large plantation and the peasant holding ; the first is capable of carrying, as an overhead, a trained technical staff, but the second is not. Even where, as in Natal and Queensland, the cultural unit is larger than a peasant holding, the perishable nature of the produce ensures that close contact is maintained with an organization capable of carrying such a staff. British agriculture is organized on an entirely different basis ; there are few, if any, units large enough to carry an adequate technical staff and there are few independent holdings comparable to that of the typical peasant.

In the second place, subsistence farming, which is the basis of a peasant system, finds no place in British agriculture which is, essentially, mixed farming with the emphasis on particular marketable products as dictated by local conditions. There is no monopolistic agency for purchasing the product and the farmer is free to raise and sell what product he pleases and to adapt his cultural practices in the manner which will, in his opinion, serve his purpose best.

Thirdly, it has to be remembered that the N.A.A.S., as established after the war, was an adaptation of an organization which had its origin in the war ; it is more than doubtful if it would ever have been brought into being in a purely peaceful atmosphere. It is an organization which has taken shape through the

[1] *I.S.J.*, 1958, **60**, 3.

shedding-off of despotic powers secured during the war and it remains linked with that other product of the war, the Agricultural Executive Committees, still endowed with immense dictatorial powers. The organization of the N.A.A.S. has yet to take final shape and it would be rash to take it as a model.

Lastly, there is a fundamental consideration which is too frequently overlooked : fundamental, because it is based on human nature. Two factors are involved. The first is that the cane industry falls into two sharply distinct sections, the field and the factory ; and the distinction is this. In the field the cultural conditions are only partially under control ; in the factory, control is practically complete. The second is that the sciences involved are classed either as exact, chemistry and physics, or inexact, biology in its widest sense. There is inherent in the exact sciences, especially when practised in a controlled environment, a natural discipline, for, if their rigid rules be ignored, the anticipated end is not attained. There is no such equivalent discipline in the case of the inexact sciences practised in an environment only partially under control, for any divergence between expected and actual results is readily explained away as due to environmental interference. Here is a ready cloak for inefficiency.

Human nature being what it is, discipline of some sort is essential if efficiency is to be maintained and, in the absence of an adequate natural discipline, some other form has to be found. But it must be discipline of the right sort and the dilemma is to find that organization which provides the required discipline without conferring excessive power on the dispenser of discipline ; it is the old question of *quis custodiet custodes* ? There is no need to argue the matter further here ; it has been argued at considerable length earlier[1]. Broadly, the answer is that no single form of organization meets all requirements; in the present context, that of the cane industry in its agricultural aspects, maximum efficiency, in the sense of the most rapid application of the results of pure research to practice, will obtain when he who is therein termed the "interpreter" finds his niche within the organized body of the industry. In that atmosphere, discipline is automatic and adequately provided by the need for delivering the goods within reasonable time.

The cane sugar industry is better situated than most branches of agriculture to adopt such a system, for the introduction of the vacuum pan has resulted in the coalescence of small into large units capable of carrying a large part of the overhead charge of a technical service, whether those units be organized on a full plantation basis or, as in Fiji, on what has been termed a co-partnership basis. Nor has the industry been slow to seize the opportunity. As early as the latter part of last century, first in Java and then in Hawaii the sugar industries established Experiment Stations strongly manned by technical staffs. Java has unfortunately but, it is to be hoped, only temporarily, dropped out of the running, but Hawaii remains as offering outstanding proof of the resultant benefits derived both in the productivity of the industry, whatever be the yard-measure adopted, and in the expansion of its technical organization.

It is not possible here to follow the corresponding developments in all the cane growing territories, nor is it desirable, for comparisons are odious : but there is ample evidence of an ever-growing tendency to bring at least "applied research"—the "interpreter" function—within the folds of the industry. The Association before whom the Address was delivered offers an advanced step towards building the industry into an organization sufficiently strong to carry as an overhead a technical staff. The problem presents itself in its most intractable form where cane is grown by bodies of small, independent peasants, of which Northern India is the most outstanding example. Here recent developments in the land tenure system have, most unfortunately, abolished the "zamindar", a potential agent both for the provision of capital and as a centre of a co-partnership organization. There remains only the co-operative movement which, if the arguments here advanced are sound, is incapable of developing maximum efficiency, for it cannot be woven into the industry and must be subject to official control however light the rein on which it is driven.

H. M.-L.

Cytological Studies in *Saccharum* and allied Genera. III. Chromosome numbers in interspecific hybrids. S. PRICE. *Bot. Gaz.* 1957, **118**, 146–59.; through *Plant Breeding Abstracts*, 1957.—Chromosome numbers are reported for 58 true hybrids representing combinations of *S. officinarum* × *S. robustum*, *S. officinarum* × *Spontaneum*, *S. sinense* (Pansahi group) × *S. officinarum*, *S. officinarum* × *S. sinense* (Saretha group), *S. robustum* × *S. spontaneum* and *S. sinense* (Sunnabile and Saretha groups) × *S. spontaneum*. Literature dealing with chromosome numbers in interspecific and intergeneric hybrids of *Saccharum* is reviewed and discussed.

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A Small Cane Harvester. L. L. LAUDEN. *Sugar Bull.*, 1958, **36**, 126, 131.—A brief description is given of a one-man operated harvester stated to be the smallest, simplest, lightest and most compact machine made. It is 4 wheeled and weighs, when fully equipped, 6,760 lb.

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Mechanical Cane Break Pusher. ANON. *Producer's Rev.*, 1957, 47, (12), 21.—Three illustrations are given, two of which are of the implement and one of the very effective break made between two cane rows.

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Australian and Fijian Sugar Industries. R. J. LEFFINGWELL. *Sugar J.* (*La*)., 1957, **20**, 16–18, 38.—A necessarily brief overall picture of the respective industries in Australia and Fiji is given.

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[1] *I.S.J.*, 1946, **48**, 228.

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BULK RAW SUGAR LOADING IN QUEENSLAND

Installation at the Port of Mackay

By E. M. PLOMLEY
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WITHIN the next few years most raw sugar in Australia, whether for Australian or overseas discharge, will be handled in bulk without being bagged at any stage. The conversion to bulk handling commenced in 1954 when relatively small bulk installations were completed at two of the Colonial Sugar Refining Company's mills in northern New South Wales; the bulk raws were mechanically handled from bulk storage into small coasting vessels, which were unloaded at the C.S.R. Company's Pyrmont Refinery in Sydney by a coal unloading crane. During 1955, a large-scale mechanized bulk unloading and receiving installation was completed at the Sydney Refinery; at that company's Yarraville Refinery in Melbourne sugar was unloaded in bulk using grabs operated by ship's gear. Apart from the New South Wales sugar arriving by small coaster, bulk cargoes for these refineries and for export destinations in the United Kingdom were loaded by bleeding bagged sugar into ships' holds at Queensland ports.

The first mechanized bulk loading installation for raw sugar in Queensland (as distinct from New South Wales) has recently been completed at Mackay and vessels of 10,000 tons capacity are being loaded mechanically in less than two days of elapsed time from the start of loading. The rate is about 600 tons per hour of actual loading time. This compares with hand loading of bagged sugar at a rate of about 65 tons per hour, and a total time to load a 10,000 tons cargo of some three weeks.

The consulting engineers for the project were Messrs. Macdonald Wagner & Priddle of Sydney who engaged the Colonial Sugar Refining Co. as their associate consultants to design and supervise all mechanical and electrical equipment in the installation.

The plant consists essentially of four main elements: receiving system; storage building; system of recovery from bulk and conveying to wharf; and gantry loader.

Fig. 1. Aerial view of Mackay Harbour and bulk terminal.

Receiving System

All raw sugar produced in the district is removed from the seven mills each day as it is made, and transported from 8 to 46 miles to the bulk installation. Five mills send in the sugar by rail and two by road. The bulk installation provides all storage for the district's raw sugar. From the receipt of the first sugar in June 1957 to the end of the year, the installation had received into store about 306,000 tons and the maximum quantity in store was about 136,000 tons. Up to 3000 tons is taken into storage each 10 hour day for five days each week of the crushing season, which extends from about June to December of each year.

The mills load sugar into steel-framed plywood-lined boxes each holding about 6 tons. Four boxes

are mounted on each rail vehicle and two on each road vehicle. The boxes are loaded at the mill through a top door and discharged at the bulk store through a side door which automatically unlatches and swings away from the box side when the boxes are tilted sideways. The discharged sugar falls into a receiving hopper. On one side of the receiving hopper is a 40 ft long weighbridge for road vehicles, and on the other side a similar weighbridge for rail vehicles. The gross and tare weights of each vehicle are taken while it is on the bridge and a sample of sugar from each box is taken while the sugar is being discharged. These weights and samples provide the basis of payment to mills, subject to adjustment for final outturn from the terminal. The average cycle times are 3 min for road and 6 min for rail vehicles.

Fig 2. Raw sugar being loaded into boxes from the 300-ton bin at Farleigh mill.

Sugar is fed from the receiving hopper by a 24 in wide steel band conveyor to a 30 in wide rubber band conveyor system, from the second band of which the sugar is fed to a 30 in wide shuttle conveyor in the centre of the apex of the bulk storage building. This reversible conveyor is 400 ft long and can be traversed in either direction to distribute the sugar in the building. The conveyors run at 375 ft per min and convey sugar at a rate of 300 tons per hour. The slope of the inclined conveyor from the receiving station to the roof of the shed is approximately 16°.

Storage Building

This building is 995 ft long and 150 ft between side retaining walls of reinforced concrete, 17 ft high from the floor. The building is of steel frame construction with columns supported on the side walls. The slope of the roof corresponds approximately to the angle of repose of the sugar. Efforts were made to render the building airtight, and ventilation may be effected by fans in each end and in the roof of the building. The area of unobstructed floor space is 3½ acres.

Recovery from Storage for Loading

Along the centre line of the floor of the storage building is a continuous row of hoppers each measuring 12 ft × 10 ft. Each hopper is fitted with an

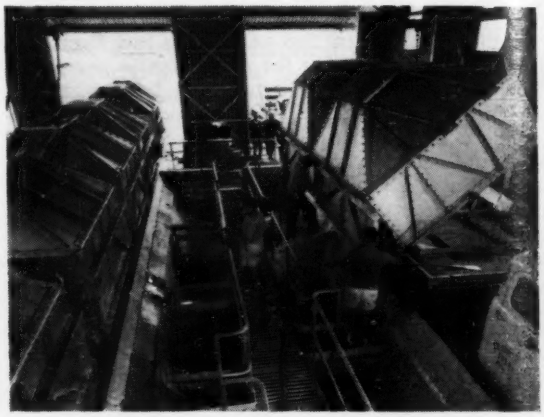

Fig 3. Receiving station for road vehicles (right) and rail vehicles (left).

outlet door through which the flow of sugar can be controlled on to a 42 in rubber band conveyor in a tunnel running the full length of the building.

The 42 in band runs at 450 ft per min and removes the sugar at 650 tons per hour, this rate being normally obtained through two hoppers. The maximum height of sugar standing over these hoppers is about

Fig 4. Storage building showing the conveyor from the receiving station (right)

70 ft and no difficulty has yet been experienced due to bridging or arching.

The flow of sugar from the floor to the hoppers, especially the sugar lying towards the sides of the shed, is assisted by two electrically-driven excavators

each of a nominal 1½ cubic yard capacity fitted with a 2½ cubic yard bucket. The tracks of these machines are faced with rubber to minimise damage to the floor.

After passing out from below the storage shed the sugar is elevated on a further 42 in rubber band conveyor to the top of a weigh-tower which houses a 10 ton batch automatic weigher made by N.V. Servo Balans of Holland. The rate of weighing is 650 tons per hour and a sample is taken from each batch. Test weights totalling 15 tons are incorporated in the machine; they can be applied by an electric motor so that tests for accuracy can be made rapidly.

Fig 5. Interior of the storage shed.

From the weigh-tower, the sugar is carried on 42 in rubber band conveyors, one 730 ft and the other 674 ft long, the latter being carried mainly in an open-sided gallery above the loading berth. A conventional-type tripper carried by the loading gantry removes sugar from this belt and feeds it to cross conveyors on the gantry, the second of which feeds to the vertical loading spout into the ship's hold.

Gantry Loader

The gantry loader is carried on two rails at wharf deck level running the full length of the loading berth. It carries a luffing boom in which a movable trolley carrying the head gear of the final conveyor supports a 24 in diameter telescopic stainless steel tube, down which sugar falls to the ship's hold. At the lower end of the tube is suspended an electrically-driven trimmer (thrower) which consists essentially of a short 42 in wide rubber belt moving at a speed of over 3000 ft per min. Sugar is picked up by the belt and thrown horizontally a distance of 40–50 ft. The trimmer can be rotated through 360° and can be raised or lowered by the telescopic chute. In this way sugar can be thrown to any part of the ship's hold and can be stowed tight up under decks.

The specially made belt for the trimmer has so far handled over 150,000 tons of sugar and the surface is still in excellent condition.

The luffing boom enables the chute and trimmer to be retracted rapidly and returned from the ship's holds, and the gantry loader can be rapidly moved from hatch to hatch. The elapsed time from cessation of sugar flow in one hold to start of flow in the next is 15–20 minutes.

The speeds of operation of the various movements are: travel along wharf 80 ft per min, cross travel of chute and trimmer 10 ft per min, raise or lower trimmer 10 ft per min, rotation of trimmer 1·4 r.p.m., raise boom from horizontal to vertical 3½ min.

All these speeds have proved satisfactory in practice and no amendments are proposed for gantries at terminals now under construction. Apart from a few teething troubles, the gantry and trimmer at Mackay have operated in a satisfactory manner.

Control

Complete control of sugar loading operations is in the hands of one man stationed on the gantry loader boom, using a portable push-button station. Control of the sugar flow is by one push-button starting the trimmer, which starts the previous conveyor through a speed switch. The five conveyors in the loading system are in turn each started by a speed switch driven by the preceding conveyor. The portable station also contains push-buttons for controlling travel of the gantry, luffing of the boom, movement of the trimmer athwartships, fore and aft and up and down, and rotations of the trimmer.

A closed circuit industrial television set has been installed to assist the operator on the gantry boom

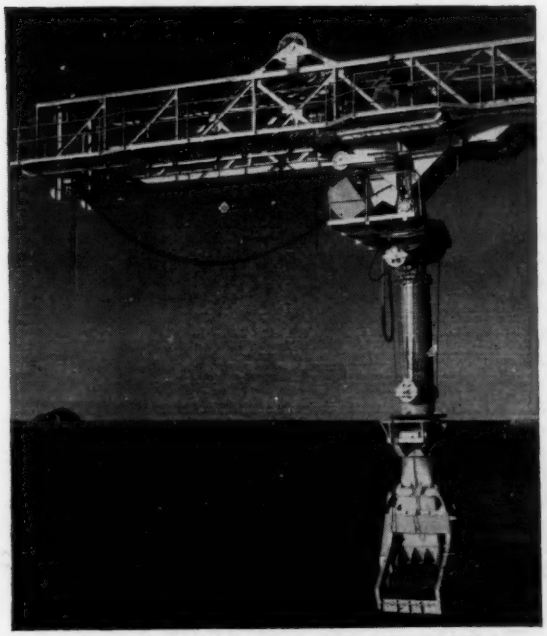

Fig 6. The gantry loader, telescopic chute and trimmer.

in seeing the progress of loading in the hold below him. The camera is mounted on the trimmer and a very wide angle lens has had to be fitted. Difficulty has been experienced with sugar dust and in arranging lighting to overcome the great contrast between tropical sunlight and the shadows underneath the ship's decks.

It was not possible to run the ship loading system on load or to make any running adjustments before the first ship started to load. This ship started to receive sugar on 7th August 1957, and sailed on 10th August. She was loaded with 10,405 tons in 23¼ hours actual loading time, the average loading rate being 450 tons per hour.

To the end of 1957, 20 ships were loaded with about 10,000 tons of sugar each, the actual loading times varying from 16 to 20 hours. The average length of stay in port was from two to three days.

Installations generally similar to Mackay will be completed during 1958 at the ports of Lucinda and Bundaberg, and other ports will follow.

The general economic planning of the conversion of the industry to the bulk basis was carried out by the Colonial Sugar Refining Company for the Queensland Sugar Board, and the plans were approved by other Australian sugar industry organisations and governmental authorities. Broad specifications as to the requirements and capacities of the terminals were worked out by the Company, taking into account shipping, marketing, land transport and other questions.

The Mackay Terminal is owned by the Mackay Harbour Board and, under a long-term leasing arrangement, its operations are controlled by an organization representative of the sugar industry. Somewhat similar arrangements will apply at the other Queensland loading terminals.

ROUTINE CONTROL OF THE FINENESS OF ICING SUGAR

By S. HILL and E. G. MULLER (Tate & Lyle Research Laboratory), Keston, Kent.

Introduction.

A previous paper[1] describes a method for the determination of the particle size distributions of icing sugars, in which a preliminary classification of the sample by air elutriation is followed by observation of the particles under a projection microscope. While this method has been useful in particular cases and has established the basic particle size distribution of pulverised sugars, it is too elaborate for the routine control of icing sugar manufacture.

A method of fineness measurement for routine control is described here. It comprises determinations of the specific surface and the percentage retained on a 150 mesh sieve.

The specific surface (surface area per unit mass) of a powder consisting of non-porous particles is a measure of the average fineness of the powder and it can be determined relatively easily. If this measurement is made on a sample of icing sugar and is supplemented by a determination of the percentage of large particles (on a 150 mesh sieve) reasonably complete information concerning the particle size distribution is available. An unduly great percentage of large particles indicates faults in the icing sugar mill. Very large particles may impair the appearance of the final iced product.

Measurement of the Specific Surface.

The fluid permeability method for the determination of specific surface is due to Carman[2], who used a theoretical expression, derived by Kozeny, to determine the specific surfaces of granular solids. Carman used liquids as the permeating fluids. The use of air for fine powders was introduced by Lea and Nurse[3]. A more compact form of air permeability apparatus for fineness determination was developed by Rigden[4], and this type of instrument was used for the present investigation. The instrument is shown in Figs. 1 and 2*. A cylindrical stainless steel permeability cell C, shown in detail in Fig. 3, contains a measured weight of sugar which is compacted to a standard volume by means of a plunger P. The plunger, also of stainless steel, fits closely into the cell. Its movement into the cell is limited by the flange H. In the cell the sugar is supported on a disc of filter paper F (Whatman No. 54), which is retained in position by a perforated brass disc D. The cell is connected via taps T_1 and T_2 to the ends of a U-tube which is made from "Veridia" precision bore Hysil tube (Chance Bros., Ltd.). The U-tube contains low vapour pressure oil ("Apiezon A").

In order to carry out a measurement the cell is weighed to ±0·01 g. Between 4·75 and 5·00 g of icing sugar are put into the cell. This weight of sugar is chosen so that the sugar, after compression into

[1] *I.S.J.*, 1958, **60**, 128.
[2] *J. Soc. Chem. Ind.*, 1938, **57**, 225 ; 1939, **58**, 1.
[3] *Ibid.* 1939, **58**, 279.
Symposium on Particle Size Analysis, Inst. Chem. Eng., 1947.
[4] *Ibid.*, 1943, **62**, 1.

*The permeability cell shown in Fig. 2 is of an earlier design than that shown in Fig 3.

the standard volume of 5·07 c.c., will have a void fraction between 0·41 and 0·38. This gives a firm but easily compacted bed of sugar. The plunger is inserted, struck until the flange rests on the upper edge of the cell, and then carefully withdrawn. Any sugar adhering to the wall of the cell is removed and the

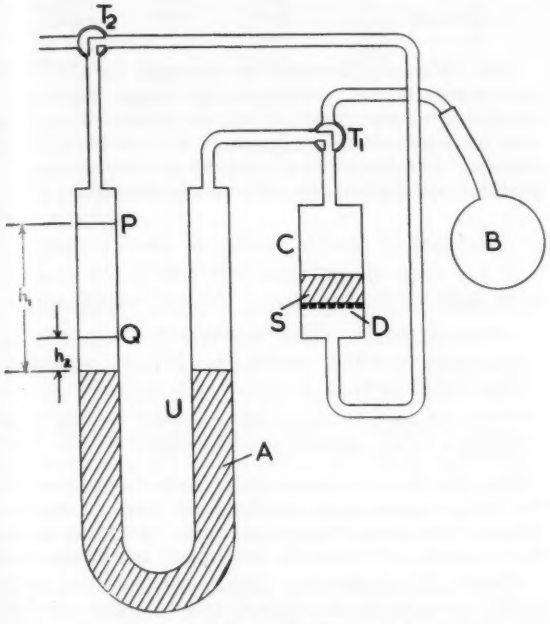

Fig. 1. Air permeability apparatus.

Key: *A* Apiezon oil; *B* bulb; *C* permeability cell; *S* Icing sugar; *D* perforated disc; *U* U-tube; T_1, T_2 taps; *P*, *Q* initial and final oil levels.

cell is weighed again. The cell is fitted into its air-tight mounting and the level of the oil meniscus in the left hand member of the U-tube is elevated above the upper mark P by pressure from the rubber bulb B. After taps T_1 and T_2 have been reset the oil levels return slowly towards equilibrium. The fall time of the oil meniscus from P to Q is observed. During this time a known volume of air is forced through the bed of sugar. The fall time depends on the constants of the instrument and the flow resistance of the bed of sugar. The latter is a function of the mass of sugar and its specific surface.

Three of these instruments have been constructed for use in the Refineries of Tate & Lyle, Ltd. and have given satisfactory service for a number of years.

The Kozeny equation for the flow of air through a cylindrical bed of powder is :

$$u = \frac{e^3}{(1-e)^2} \cdot \frac{P}{k\eta LS^2\rho^2}$$

in which

u = open tube rate of flow (cm/sec),

e = void fraction of the bed $= (1 - \frac{M}{V\rho})$,

P = pressure difference across the bed (dynes/sq.cm),

k = Kozeny's constant = 5·0,

η = viscosity of air = $1{\cdot}80 \times 10^{-4}$ poises at 17°C,

L = depth of the bed (cm),

S = specific surface of the powder (sq.cm./g),

ρ = density of the powder, (g/c.c.)

V = volume of the bed (c.c.),

and M = mass of packed powder (g).

Applying this expression to the U-tube type of instrument we obtain :

$$S = K \frac{e\sqrt{e}}{(1-e)} T$$

in which T = the fall time from P to Q (sec) and

$$K = \frac{2Ag\sigma}{\rho^2 k a L \eta \log_e (\frac{h_1}{h_2})}$$

The additional symbols are :

A = cross sectional area of the cell (sq.cm.),

g = acceleration due to gravity = 981 cm/sec²,

σ = density of the oil (g/c.c.),

a = cross sectional area of the U-tube (sq. cm.),

h_1 and h_2 = heights of P and Q respectively above the equilibrium level of the oil.

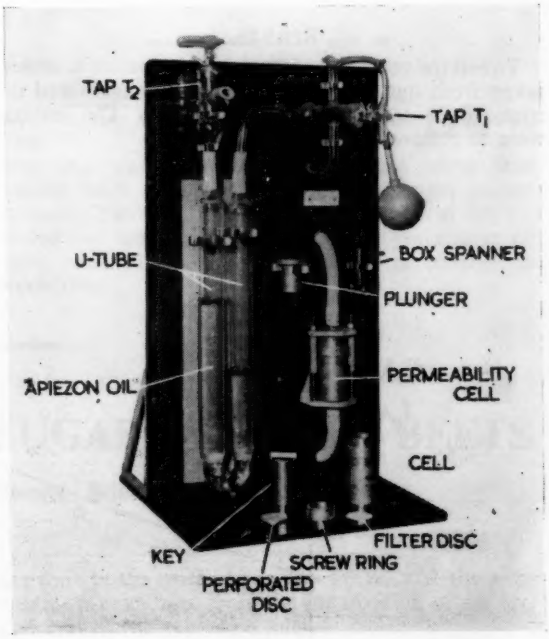

Fig. 2.

For a given instrument K is constant and can be calculated. V and ρ (in the expression for the void fraction) are also constant so the only independent variables are M and T. For routine use it is convenient

to construct a nomogram in which S is given as a function of M and T.

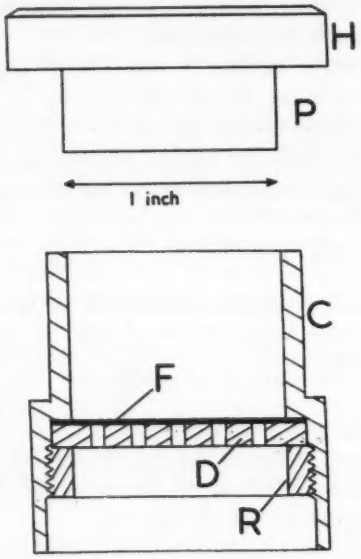

Fig. 3. Permeability cell.

Key: *C* cell; *P* plunger; *F* filter paper disc; *D* perforated disc; *R* retaining ring; *H* flange.

Results.

To test the precision of the method separate samples taken from one lot of icing sugar were measured in triplicate in each of three instruments. The results were as follows :

Table 1.

Specific Surface (sq.cm./g)

	Instruments		
	1	2	3
Sample 1	4530	4520	4480
Sample 2	4220	4610	4560
Sample 3	4620	4640	4220
Average	4457	4590	4420

The differences between the averages for the three instruments are not statistically significant. The standard error of the mean of two determinations with one instrument is 116 sq.cm./g, or 2·6% of the specific surface. For purposes of routine control two independent determinations are recommended.

Relation of specific surface to particle size.

It has been shown[1] that the size distribution of icing sugar can be described in terms of two quantities:

The geometric mean aperture (i.e. the size of the aperture which would pass 50% by weight of the sample) and

The geometric standard deviation (which is a measure of the diversity of the sizes).

Since the latter has been shown to be fairly constant for icing sugars made in the same type of mill it follows that, under these conditions, the mean aperture alone is a fairly good description of the sample.

Eight samples of icing sugar, manufactured in a variety of mills, were subjected to a complete particle size analysis and their specific surfaces were also determined. The relation between the mean aperture and the specific surface is shown in Table 2 and Fig 4.

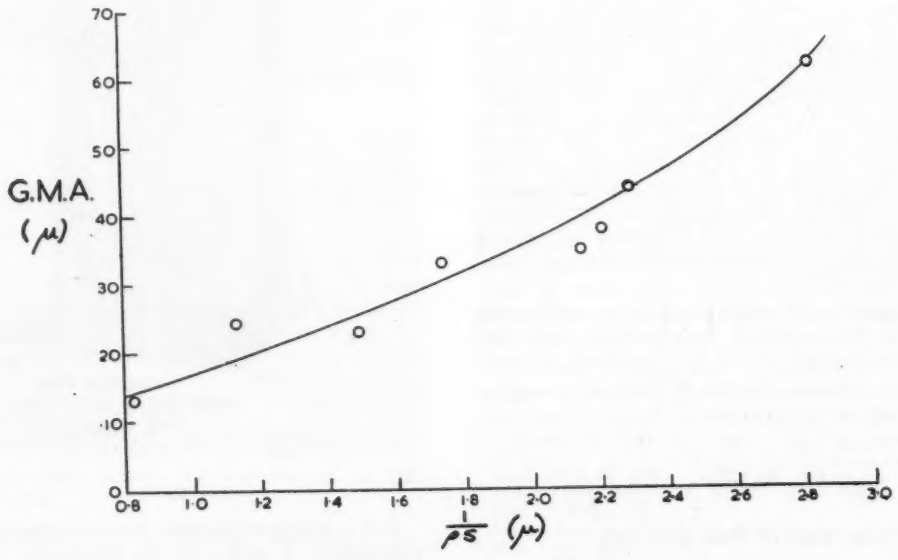

Fig. 4. Relation between G.M.A. and Specific Surface.

Table 2.

Sample	Type	S (sq.cm./g.)	$\frac{1}{\rho S}$ (microns)	G.M.A. (microns)
1	Hammer mill 1 ..	2950	2·145	35
2	Hammer mill 2 ..	2870	2·205	38
3	Hammer mill 3 ..	3650	1·73	33
4	Double milled	4260	1·49	23
5	Pin mill	2250	2·81	62
6	Unknown	2770	2·285	44
7	Air separated	5600	1·125	24
8	American	7630	0·825	13

The high degree of correlation shown in Fig. 4 between the specific surface and the mean aperture is the justification for this rapid experimental method. It shows that the measurement of the specific surface gives a good indication of the general fineness of the icing sugar.

"*Overs of* 150 *Mesh*".

The specific surface measurement is supplemented by sieving on 150-mesh (Tyler) with water-free acetone.

The presence of a considerable percentage of large particles (greater than 0·0041 inches) in icing sugar can be troublesome to the user, particularly to the highly skilled icing sugar craftsman. These particles may block the jets of piping tools. They may also leave streaks on the iced cake when they are dragged across the surface by the smoothing knife. Normally the percentage of these large particles is quite small, and substantial variations in this percentage can occur without perceptibly changing the specific surface. An independent estimate of the large particles is therefore required. The present method of estimation, developed by Mr. E. C. TUBB of Tate and Lyle, Ltd. enables the "overs of 150 mesh" to be measured directly and conveniently.

The apparatus used is shown in Fig. 5. A circular piece of standard Tyler 150 mesh, M, is soldered to a brass ring R. The ring can be fitted to the bottom of a brass funnel, F, and held in position by a brass collar, C, with a bayonet fitting B.

The sieve is weighed and fitted to the funnel. 10 g of icing sugar are washed into a conical flask with about 100 ml of water-free acetone, and the stoppered flask is shaken for about 1 minute to disperse the sugar. The suspension is poured on the

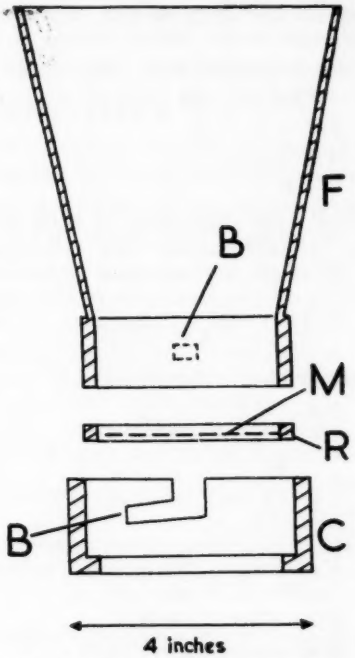

Fig. 5. Apparatus for wet sieving.

Key: *F* funnel; *M* mesh; *R* brass ring; *C* collar; *B* bayonet fitting.

sieve and washed through with more water free acetone from a fine jet until no more sugar passes through. The sieve is dried for 10 minutes at 105°C, cooled and weighed to determine the percentage of sugar retained. A retention of 5% is considered acceptable.

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THE DETERMINATION OF SUGAR IN SUGAR BEETS

By Wm. H. PARKER, M.Sc. Chief Chemist, British Sugar Corp. Ltd.

PART IV.

ANALYTICAL PROCEDURE (*cont.*).

III. The "Juice Volume".

THE volume of 23 ml used by SACHS and LE DOCHTE in their standard method is based on an average figure for the marc content of beet material and is open to objections which are well known. In the method used by D'ORANZI[1] the juice volume is calculated from the polarization of the brei and that of the expressed juice.

This method assumes that all the sugar in the brei is in the liquid phase and is completely extracted by the analytical procedure. This is ensured by using either an agitator or a macerator if the extraction

[1] *Ind. Sacc. Ital.*, 1952, **45**, 82, 87.

takes place in the cold (cold water digestion method), or by hot water digestion using the 177 ml pipette of SACHS and LE DOCHTE.

The juice volume is calculated as follows:

Suppose A is the polarization of the brei, J is the volume of juice in 26 grams brei, and S is the % by weight of sugar in the brei.

Then the concentration of sugar in the filtrate is

$$\frac{0{\cdot}26S}{177+J} \times \frac{100}{1} = 0{\cdot}13A$$

$$\text{or } S = \frac{177+J}{200} \times A \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Suppose B is the polarization of 23 ml of expressed juice + 177 ml basic lead acetate (B.L.A.).

Then the sugar concentration in the expressed juice is

$$\frac{0{\cdot}26S \times 100}{J} \text{ g in 100 ml}$$

$\therefore$ Concentration in the filtrate is

$$\frac{26S}{J} \times \frac{23}{200} = 0{\cdot}13B.$$

$$\text{Hence } S = \frac{BJ}{23} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

Equating (1) and (2)

$$\frac{177+J}{200} A = \frac{BJ}{23}$$

$$\therefore J = \frac{23 \times 177A}{200B - 23A} = \frac{20{\cdot}36A}{B - {\cdot}115A}$$

On this basis the average values for juice volumes over three beet campaigns by this method were as follows:—

1956/57	21·52	1333 tests
1955/56.....	22·00	2518 ,,
1954/55.....	21·77	1199 ,,
3-yr. average ..	21·82	5050 ,,

IV. The effect of varying basicities and concentrations of basic lead acetate on the polarization of sugar beet extracts.

(a) Effect of basicity of B.L.A. reagent.

The following is a brief résumé of the work done by D. M. MURRAY.

Preparation of the concentrated B.L.A. reagent.— Solutions of varying basicities were prepared by boiling 430 grams of neutral lead acetate crystals with varying amounts of litharge in 1 litre of distilled water for half an hour. The mixtures were cooled and the clear liquid decanted in each case, finally being adjusted to 55°Brix (S.G. 1·26) with boiled distilled water. The quantities of litharge used and the basicities of the solutions obtained are given below. The 2·5°Brix solutions were prepared by dilution of the strong reagent with freshly boiled and cooled distilled water.

Solution No.	1	2	3	4	5	6	7
Grams Litharge	0	17	33	65	130	195	260
Basicity of Sol. at 55° Bx. ..	Nil	5·09	10·73	19·67	32·80	42·71	49·55
Basicity of Sol. at 2·5°Bx.	Nil	4·61	10·64	19·29	34·44	44·85	52·06

N.B.—The "basicity" is the basic lead expressed as % of total lead present.

The following results were obtained with the seven solutions prepared as above at 2·5°Brix on the same sample of brei in each of the ten samples tested.

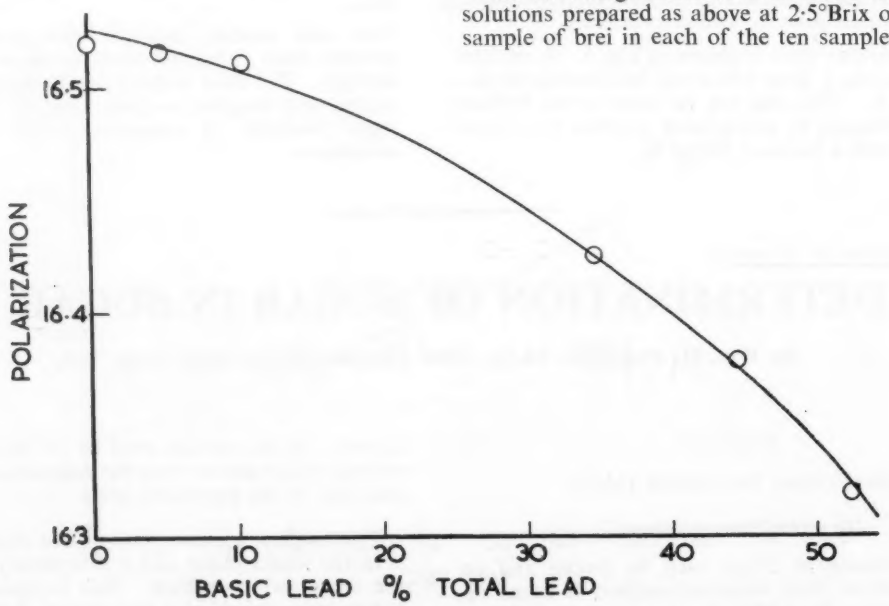

Fig. 1. Effect of varying basicities of lead acetate clarifying reagent on polarization of sugar beet brei.

Polarization of beet brei samples using 2·5° Brix solution of B.L.A.

Solution No.	1	2	3	4	5	6	7
Basicity	Nil	4·61	10·64	19·29	34·44	44·85	52·06
Sample No. *A*	16·75	16·75	16·75	16·70	16·60	16·70	16·65
,, ,, *B*	17·00	17·00	17·00	17·00	16·95	17·00	16·80
,, ,, *C*	16·20	16·20	16·20	16·10	16·05	15·95	15·90
,, ,, *D*	16·60	16·55	16·55	16·55	16·50	16·40	16·35
,, ,, *E*	16·40	16·40	16·40	16·35	16·35	16·25	16·20
,, ,, *F*	16·65	16·65	16·60	16·55	16·45	16·45	16·35
,, ,, *G*	16·50	16·50	16·50	16·50	16·45	16·35	16·35
,, ,, *H*	16·50	16·50	16·50	16·50	16·45	16·35	16·30
,, ,, *I*	16·25	16·25	16·25	16·25	16·20	17·15	16·10
,, ,, *J*	16·30	16·30	16·30	16·30	16·25	16·20	16·15
Averages	16·52	16·51	16·51	16·48	16·43	16·38	16·32

The average results are depicted graphically above (Fig. 1) which clearly shows the trend:

Taking Solution No. 5 as representing the standard used in practice the average polarization at zero basicity was 0·09% *higher* and at 52·06 basicity it was 0·11% *lower*.

(*b*) *Effect of varying concentrations of B.L.A. reagent.* (D. M. MURRAY).

Further tests were carried out using an approximately standard strength reagent of 29·5% basicity at varying densities, e.g. from 1°Bx. to 7°Bx. The results were:—

	B.L.A. solution of 29·5% basicity			
Brix	1°Bx.	3°Bx.	5°Brx.	7°Bx.
Basicities ..	22·86	27·82	27·81	28·41
Sample No. 1 ..	16·40	16·40	16·25	16·25
,, 2 ..	16·50	16·40	16·30	16·30
,, 3 ..	16·30	16·20	16·15	16·15
,, 4 ..	15·50	15·40	15·35	15·30
,, 5 ..	15·85	15·75	15·70	15·70
,, 6 ..	16·50	16·50	16·45	16·35
,, 7 ..	14·80	14·75	14·70	14·70
,, 8 ..	16·15	16·05	15·95	15·95
,, 9 ..	16·55	16·45	16·40	16·35
,, 10 ..	15·70	15·60	15·60	15·60
Averages	16·03	15·95	15·89	15·87

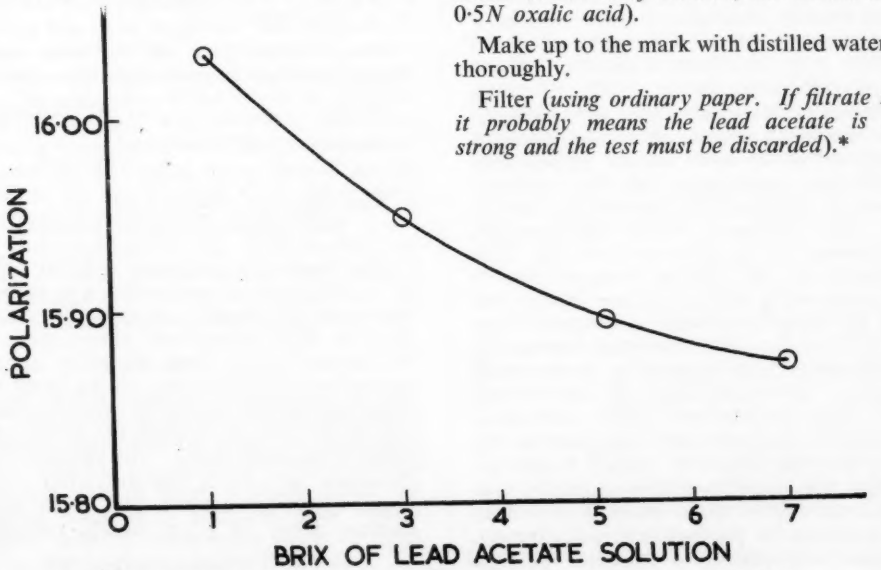

Fig. 2. Effect of increased lead concentration on polarization of sugar beet brei.

The overall effect of increasing the concentration of the clarifying reagent is thus seen to have caused a depression in the polarization and this is shown in Fig. 2.

Dilution caused a slight lowering of the basicity rather more in the case in the 1° Brix solution no doubt due to hydrolysis.

It was shown that pure sucrose solutions are affected in much the same way but further work on this is required.

V. A rapid method for the determination of the concentration and basicity of lead in B.L.A. reagent.

The solution is treated with a measured amount of standard oxalic acid and filtered. The filtrate is then titrated separately with standard NaOH and with standard $KMnO_4$. From the first result the amount of basic lead can be calculated and from the second the amount of total lead.

Three standard solutions are required:—
0·5*N* oxalic acid (31·5 g/litre); 0·1*N* sodium hydroxide and 0·1*N* potassium permanganate.

The NaOH is standardised by titration against 5 ml of the 0·5*N* oxalic acid in the presence of phenolphthalein to obtain the factor $f_1 = \frac{25}{\text{ml of } 0{\cdot}1N \text{ NaOH}}$

The potassium permanganate solution is standardised by titrating it against 5 ml of the 0·5*N* oxalic acid at 60–70°C in the presence of a few ml of dilute H_2SO_4, to obtain the factor $f_2 = \frac{25}{\text{ml of } KMnO_4}$.

Procedure for determining basicity of B.L.A.

Into a 200 ml graduated flask pipette 10 ml B.L.A. solution and 50 ml 0·5*N* oxalic acid. (*For dilute B.L.A. solutions, containing 6 ml of strong B.L.A. or thereabouts in 177 ml of solution, use 150 ml and 25 ml of 0·5N oxalic acid*).

Make up to the mark with distilled water and shake thoroughly.

Filter (*using ordinary paper. If filtrate is not clear it probably means the lead acetate is abnormally strong and the test must be discarded*).*

Titrate 40 ml of the filtrate against 0·1*N* NaOH using phenolphthalein as indicator (*giving the basic lead content*).

Note the volume of 0·1*N* NaOH used and correct by multiplying with factor f_1 if necessary.

Titrate a further 40 ml of the filtrate with 0·1*N* $KMnO_4$ at 60–70°C in presence of a few ml of dilute H_2SO_4 (*giving the total lead content*).

Note the volume of 0·1*N* $KMnO_4$ used and correct by multiplying with factor f_2 if necessary.

$$\text{Basic Pb \% total Pb} = \frac{50\dagger \text{ ml } 0{\cdot}1\ N\ \text{NaOH}}{50\dagger \text{ ml } 0{\cdot}1\ N\ KMnO_4} \times 100$$

† 25 ml in the case of dilute B.L.A. solutions.

*NOTE.—If the B.L.A. is unusually strong the 50 ml of oxalic acid may not be sufficient to cover the total lead present: in such cases it is simplest to take a smaller volume of B.L.A., say 8 ml, and correct the results accordingly.

VI. The effect of using hard water in auto-pipettes.

Comparative tests made at a number of factories using the ordinary water supply and using distilled water on duplicate samples showed that the precipitate formed when hard water was used—due to the reduction in the effective volume of the liquid in the pipette—had a significant effect on raising the polarization in some cases depending upon the degree of interaction between the strong B.L.A. and the water used, e.g.

Factory	No. of tests	Diff. in pol. found
A	188	0·006%
B	25	0·02%
C	35	0·043%
D	36	0·094%
E	194	0·02%
F	19	Nil

A demineralizer has been installed at one factory and has proved effective in reducing the precipitate error to a negligible amount. It would appear that the use of demineralized water is very desirable.

The author wishes to express his thanks to the Directors of British Sugar Corporation Limited for permission to publish this work.

ERRORS IN POLARIMETRY CAUSED BY MAGNETIC FIELDS

J. W. GATES, M.Sc., A.Inst.P. (National Physical Laboratory Light Division).

WHEN a transparent material is in a magnetic field it becomes optically active; this effect was discovered by FARADAY and bears his name. A beam of plane polarized light traversing such a transparent medium in line with the magnetic field is affected in the same way as a similar beam passing through an optically active solution, and measurements of the magnitude of the Faraday effect may be made with an ordinary polarimeter if sufficiently strong fields are used. Conversely, errors in polarimetry may arise from the effect of natural or stray magnetic fields on the sample or on the optical components of the polarimeter. It is found for most substances that the rotation θ is proportional to the length of the sample l and to the field H. The relation $\theta = VlH$ expresses this, when V is a constant for a particular material. This constant is known as the "Verdet constant" and is customarily expressed in minutes of arc rotation per oersted-cm. Its value for water and green light ($\lambda = 546$ mμ) is about 0·0152 min/oersted-cm, so a 20 cm polarimeter tube containing water would rotate the plane of polarization by $20 \times 0{\cdot}0152$ minutes in a field of 1 oersted. This rotation is 0·005° arc which is equivalent to a rotation on the sugar scale of 0·012°S. An error of this magnitude is only just less than significant in polarimetry with visual instruments, and is many times greater than the limit of accuracy of photoelectric polarimeters. Moreover, there was reason to suppose that the Verdet constant for sugar solutions and for lead solutions would be greater than for water. In consequence, some measurements were made of the Verdet constant of sugar solutions and of basic lead acetate solution, and an attempt was made to estimate the magnitude of stray fields which may affect the reading of a polarimeter.

Measurement gave the following values for the Verdet constant in green light ($\lambda = 546$ mμ).

Water	0·0152	min/oersted cm.
Basic lead acetate solution SG 1·25.....	0·0187	,, ,,
Raw sugar 26% w/v + 1 ml lead solution in 100 ml	0·0155	,, ,,

The horizontal magnetic field at selected points in a fairly typical laboratory was measured with a fluxmeter and search coil and the results indicated that the field varied from almost zero up to about 0·4 oersted away from electrical apparatus, most places having a field close to the usual value for the earth's horizontal field (0·18 oersted). Near electrical equipment with coils carrying direct current, much larger fields were found. The field at one end of the resistance unit for a mercury lamp (type ML) was found to be 1·7 oersted, and 18 in away from an electric motor of ½ h.p. rating, running light, the

Continued on page 201

SUGAR-HOUSE PRACTICE

Sugar Recovery from Final Molasses. *Technical Report* (Sugar Research Institute, Queensland), 1957, (44).—Under present Queensland conditions, the viscosity of final molasses is the main factor limiting molasses exhaustion, due to the limited capacity of the centrifugal stations. The *C*-massecuite should be cooled to the lowest practicable temperature; reheating prior to centrifugalling will then bring the molasses to an unsaturated state, but this does not undo the good work of the crystallizer provided the reheating is rapid, and time lag between reheating and centrifugalling is reduced to a matter of minutes. The use of crystallizers as reheating units is condemned, and the importance of a separate efficient reheating unit stressed. To avoid false grain formation *C*-massecuite should be dropped at a minimum degree of supersaturation. Immediate water-cooling may then be undertaken with safety in the crystallizer, without danger of false grain formation.

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Decolorizing Power of Granular Active Carbon. F. ONDA. *Proc. Research Soc. Japan Sugar Refineries' Tech.*, 1956, **5**, 44–48.—The decolorizing power of Pittsburgh CAL granular active carbon was compared with bone char and Suchar active carbon by addition of appropriate quantities of each to aliquots of various refinery solutions. The CAL carbon was found to be intermediate in decolorizing power, weight for weight, between the others, and its decolorizing power fell sharply on repeated use with darker solutions. With lighter solutions, e.g. carbonatated liquors, its decolorizing power dropped only as fast as that of bone char. Washing the used carbon with hot water at each cycle appeared to slow the rapid drop in decolorizing power.

* * *

Preparation and Nature of Sulphuric Acid-Activated Carbon (Ion Exchange Active Carbon). M. KOMOTO. *Proc. Research Soc. Japan Sugar Refineries' Tech.*, 1956, **5**, 49–71.—An active carbon is prepared by adding 1 part of sawdust to 3 parts of 85% sulphuric acid at about 90°, with stirring. The temperature rises after 2–3 min to 155–160°C and steam and SO_2 are evolved. After 10 min, the reaction product is a granular, black, relatively dry solid which is water washed until sulphate-free, and ground. It is obtained in 70% yield on weight of sawdust, and contains 72% moisture. Some 80% of the acid is recovered by the washing. The cation-exchange groups in the carbon (I.A.C.) are 20% sulphonic and 80% carboxylic acid groups. Decolorizing power and ion exchange capacity appear to be unrelated. Decolorization of caramel, molasses, washed sugar solutions, etc. was between that of "Carboraffin" and "standard Norit" (2% on syrup Brix gave 40–50% colour and 17–19% ash removal) Its pH of 3·0 lowered the pH of solutions by 1·8–1·9. Filtrates were more clear and brilliant than those obtained by other methods and filtration rates were higher. During storage, or with drying, the decolorizing power of I.A.C. dropped but its cation exchange capacity did not decrease. Unwashed reaction product, containing much sulphuric acid, kept its decolorizing power after 5 years. The exhausted I.A.C. could be regenerated by washing, alkali (NaOH) and acid (HCl) treatment, and activation with H_2SO_4.

* * *

An Automatic Continuous Defecation Process using Phosphoric Acid and Lime. E. D. GILLETTE and N. ROSENBERG. *Paper presented to Sugar Industry Technicians Inc.*, 1957; through *S.I.A.*, 1957, **19**, Abs. 601.—The lime-phosphoric acid process is used for defecation of washed raw sugar melts at Refined Syrups & Sugars, Inc. Laboratory experiments were carried out to test the effect of floc formation of the order of addition of the defecants, the amount of phosphate used, the pH to which the juice was limed and the handling characteristics of the floc. Better

Errors in Polarimetry caused by Magnetic Fields.

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field was 0·7 oersted. Vertical components of the magnetic fields were found to be much larger in some cases, but these are excluded since most polarimeters have a horizontal optical axis.

From these measurements it seems likely that a significant error could arise in rare cases, and that users of polarimeters would be well advised not to have electrical apparatus nearer than 3 or 4 feet and if possible to set the polarimeter with the aid of a compass so that the local magnetic field runs across the polarimeter tube. In the worst cases the earth's field could produce an error in a normal leaded sugar solution in a 20 cm tube of the order of 0·002°S, or a field of 1·7 oersted near electrical apparatus could produce a rotation of 0·02°S. In both cases there would be an additional error caused by the Faraday effect in the optical parts of the polarimeter which might approach the same magnitude.

The work described above has been carried out as part of the research programme of the National Physical Laboratory and this note is published by permission of the Director of the Laboratory.

SUMMARY.

The rotation of the plane of polarization of light traversing a transparent medium in a magnetic field ("Faraday effect") may affect the accuracy of measurements made with a polarimeter. Measurements indicate that the risk of error is small unless the measurement is made in a magnetic field with a strength greater than 1·7 oersteds (or about 10 times the earth's horizontal field strength in Britain).

colour removal was achieved when the lime was added to the acidified juice, and when at least 0·02% P_2O_5 was used (the optimum varying with the sugar sample). The best colour removal and juice clarity was given when the pH was at an optimum (here 6·6), but the range is wider with some sugars and to prevent inversion a pH of 7·0 may be used. The floc should not be agitated and should be separated from the defecated juice by gravity (resulting juice clarity 99%) rather than by pumping the juice to a filter (clarity 83%). To maintain these recommendations in practice an automatic continuous pipe line defecation process was installed. The apparatus consists of suitable gravity flow tanks and pipes leading to the Jacobs clarifiers. The addition of phosphoric acid (75%) and lime-sucrate takes place in these 4 in pipes. The acid supply is controlled by a flowmeter which is controlled by a ratio controller which receives air signals from a "Rotasleeve Flowrator" in the line to the clarifier ; the mixing is carried out by "Nettco Flomix" units, and pH measurements on pumped samples are used to control the lime-sucrate supply. The pH values and flow rates are continuously recorded. The process has been operating for 1½ years and the advantages claimed are those of reduced labour and chemical costs and increased efficiency

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Use of Nylon Cloth Covers for Sweetland Press Leaves. J. S. LANGER and P. F. SCHUHMANN. *Paper presented to Sugar Industry Technicians Inc.*, 1957 ; through *S.I.A.*, 1957, **19**, Abs. 646.—Comparative tests were carried out on cotton and nylon cloths for filtering raw sugar melts. The nylon was a satisfactory substitute for cotton cloth, giving a flow rate comparable to that of cotton, having a 40% greater throughput, and having no sweetening-off or sluicing differences. The nylon cloth had a working life of four months (cotton two months) but could be satisfactorily regenerated by treatment first with NaOH and then with HCl, both in dilute solution. The flow rate of the regenerated cloth was 95% of the new nylon cloth and had a working life of three months. The cloths were successfully regenerated twice more before they were finally discarded ; the total working life was 12 months. Minor repairs to the cloths were necessary after each regeneration. Details of the regeneration process are tabulated and recommendations are given for long use of the nylon cloths. The initial high cost of nylon was more than compensated by the repeated use. Considerable savings of labour and filter aid were achieved as well as an increase in the available press capacity.

* * *

New Sugar Dryer and Cooler. ANON. *Food Manuf.*, 1957, **32**, 369, 387.—The new Werkspoor "grasshopper" dryer and cooler is of 25 tons per hour capacity and cools sugar from 85° to 40°C. Sugar is passed along the dryer over upwardly-directed air currents through special louvres which may be warm for drying water-washed sugars. Dust, collected by a hood, is returned to process after trapping in water or dilute syrup. The dryer has lower costs and crystal breakage than other equipment, according to experience in 1955/57.

* * *

New Sugar Mill in Thailand's Cholburi. J. C. P. CHEN. *Taiwan Sugar*, 1957, **4**, (7), 15–21.—An illustrated account is given of the Cholburi factory which crushed its first crop in 1956/57. It is a 1000 metric tons cane per day factory, with a 12-roller 28 × 54 in Stork-Werkspoor mill tandem driven by a single engine. The raw juice is weighed, heated and sulphited to pH 3·8, followed by liming to pH 7·2. After clarification in a Dorr unit, the clear juice is evaporated in a quadruple effect while the mud passes to an Oliver-Campbell rotary vacuum filter. After syrup sulphitation to pH 5·3–6·6, sugar is boiled in four calandria pans, dropped to seven crystallizers and purged in 10 Watson Laidlaw centrifugals. In the boiling scheme to be used A-massecuite is boiled on syrup and B-massecuite on A-molasses, the sugar being purged in A and B foreworkers. They are mingled together with high-purity washings and purged in afterworkers to give a 99·8 pol sugar. C-massecuite is boiled on B-molasses and double-purged before using as seed for the A and B-massecuites. In the first season, low juice purity caused a two-boiling scheme to be used.

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The Work of Sugar Refineries. I. F. ZELIKMAN and M. D. OIKHMAN. *Sakhar. Prom.*, 1957, (8), 19–22.—Refined sugar production in Russia since 1940 is discussed. Improvements in output and quality are attributed to the replacement of the sugar loaf process by the pressed sugar process. Considerable deterioration in the colour of the refined product has occurred however, the colour of the 1st product syrup having increased on an average by 4·17°St., 1955 mean colour being 10·7°. This is attributed to the high colour of the unfiltered syrups, a reduction in the amount of adsorbents used (10·21% in 1955 as opposed to 12·1% in 1940), and to poor regeneration of the adsorbents. Technological improvements in many factories are badly needed.

* * *

Plywood Tubes for External Piping in Sugar Factories. P. I. SILIN. *Sakhar. Prom.*, 1957, (8), 41–43.—Plywood pipe sections 5–7 m long and capable of handling weak acids and weak alkalis within pH 4–10 have been constructed for various industries in Russia. A pipe of 200 mm i.d. and 600 m long has been successfully used at Kupyan sugar factory for 2 campaigns for acid press-water pumped at 2·5 atm. Unions are of plywood, and the sections can be connected to metal pipes if required. Thicknesses range from 6·5 to 13 mm, internal diameters from 50 to 300 mm. Many advantages are claimed.

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Steaming Out 2nd Product Vacuum Pans with the Valve Closed. L. P. SOFRONYUK. *Sakhar. Prom.*, 1957, (8), 44–45.—At Lannov factory a new method

of steaming out the 2nd product pans has been tested whereby the discharge valve is closed 3–5 min after steam is introduced. At the same time the small auxiliary air valve is opened and the pan steamed out.

* * *

Boiling Out the Evaporator. P. P. BLONSKII. *Sakhar. Prom.*, 1957, (8), 45.—At Sitovets factory diffusion water heated to 90° with exhaust steam is used to boil out the evaporators. It is claimed that much time is saved by this method.

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Rational Condensate Scheme. M. L. VAISMAN. *Sakhar. Prom.*, 1957, (8), 55–59.—A detailed description is given of a system of condensate feed for a quadruple effect evaporator where water columns act as steam traps and condensate collectors.

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Decolorizing Ion Exchangers. I. K. CIZ, J. STAMBERG, and V. VALTER. *Listy Cukr.*, 1957, **73**, 182–184.—Criteria for the choice of decolorizing carbons such as "Norit" and "Carboraffin" are presented, and the synthesis and characteristics of colour-adsorbing ion exchange resins are reviewed.

* * *

Evaluation of the TP-2 Turbo-Generator Unit. M. KOSEK and M. PIETRZAK. *Gaz. Cukr.*, 1957, **59**, 201–204.—The unit comprises a steam-turbine and an electric generator of Polish design and was installed at Klecina beet factory in an existing circuit. Its maximum output is 1800 kW. As 1900 kW is the power requirement of the factory, supplementary generators were used during the 1956 campaign. Pure filtered water is needed for cooling, as impure water caused maintenance difficulties. Difficulties in maintenance during continuous operation are among the disadvantages.

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Results of Tests with 2nd Product Vacuum Pans. V. T. GARYAZHA. *Sakhar. Prom.*, 1957, (9), 15–20.—Results of tests with a half-ring coil pan at Gnivan' and with a calandria pan at the Stalin factory are compared. The results are tabulated and expressed in graphs showing variation of heat transfer coefficient during boiling in the pans, temperature distribution in the massecuite between the coil elements, and variation of massecuite properties during boiling under optimal conditions. The coil pan, of 32-ton capacity (compared with 40 tons capacity of the calandria pan), boiled a strike in 500–700 min (compared with 315–380 in the other). Steam temperature in the coil pan was 2–3° lower (at 122–123°C), while the massecuite, of 67 purity, had a concentration 0·5–1% higher (at 95–96% dry solids) than that from the calandria pan. Other data are roughly the same for both pans.

* * *

From Experience with Centrifugals. A. I. BELOV. *Sakhar Prom.*, 1957, (9), 30–31.—Modification of the filling device in the 2nd product centrifugals at the Stalin factory is described. The conical bottom was discarded and a cover attached to the upper frame of the centrifugal. Through a hole in one half of this cover a loading chute extends into the basket, while the other half of the cover comprises two hinged sectors which open. A deflector is situated between the top of the chute and the actual cover. The chute extends to within 350–400 mm of the bottom of the basket. Charging of the massecuite is as normal. The chute is not removed for discharge of the sugar and so no time is lost as in removal and replacement of the conical bottom. Two of these flat-bottomed centrifugals operated during the 1956/56 campaign, one at 960 r.p.m., the other at 1500 r.p.m. To reduce the time taken in replacing worn-out Ferodo brake linings on centrifugal brakes, four strips pierced at the ends were attached across the steel band, so that they extended 5–7 mm beyond each edge of the band. The Ferodo lining is attached to an intermediate band which is fitted with lugs, by which it is bolted to the pierced ends of the strips. Thus the lining can be removed by simply removing 8 bolts.

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Steam Separation within the Boiler. M. L. GLEIBMAN. *Sakhar. Prom.*, 1957, (9), 53.—To adjust the otherwise greatly fluctuating rate of steam flow from the water tubes of a Stirling boiler at Buryn factory and thus improve separation of water from the steam, perforated screens were installed in the upper drums 50 mm below the minimum water level. The steam formed in the first row of tubes hits the screen, passes below it, and is discharged on to the surface in the zones of the third and fourth rows of tubes. Baffle plates of the same design and dimensions are installed in the steam withdrawal main. Steam withdrawal is controlled by an automatic manometer.

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Polyamide Cloths in Sugar Manufacture. J. MLCHOVÁ. *Listy Cukr.*, 1957, **73**, 206–208.—The use of "Silon" (Czechoslovakian nylon) filter cloths is discussed and the results of factory tests tabulated. Also tabulated are the results of washing tests with e.g. HCl, lactic acid, "Versene", ammonium citrate, etc. Use of the cloths is advocated in view of their technological and economical advantages.

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Decolorizing Ion-Exchangers. II Experimental Station for Investigation of Ion-Exchangers. K. CIZ, I. FILIPCZAK, Z. MENCL, and V. VALTER. *Listy Cukr.*, 1957, **73**, 209–213.—The experimental ion-exchange plants installed at Prelouc beet factory and at Skrivany refinery are described. The former consists of rubber-lined metal filters, the latter of glass ("Simax") filters with automatic control of pneumatically operated valves. Both plants are intended for testing decolorizing ion exchange resins, especially "Wolfatit E" and "Centsanol W 291" and certain Czechoslovakian resins. Results of these tests are to appear later.

Modern Heat Economy in the Sugar Industry. Z. KOKELI. *Gaz. Cukr.*, 1957, **59**, 233–237.—The various methods adopted for heat economy in the beet factory are reviewed. Two types of apparatus for effecting heat economy are recommended. These are: a thermo-compressor using vapour bled from a multiple-effect evaporator for use in a factory with a daily throughput of less than 1800 metric tons, and a turbo-compressor manufactured by Escher-Wyss A.G. or Société Rateau for a factory processing more than 1800 tons of beet per day. Thermo-compressors are constructed by a number of European firms. Disadvantages of both types are mentioned. Flow sheets are given for each compressor, showing how they may be installed in existing systems.

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"Elmo" Water-Ring Pumps. J. ORZESZKO. *Gaz. Cukr.*, 1957, **59**, 237–239.—The "Elmo" water-ring pump is described and illustrated. The impeller operates at a speed of 725 r.p.m., and is powered by a 55 kW electric motor. Nominal throughput is 30 cu.m. of CO_2 per hour at 32% concentration, 250 litres/min of water being consumed.

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Double Affination of 2nd and 3rd Products. (A) R. KRAJEWSKI. *Gaz. Cukr.*, 1957, 59, 243–244. (B) S. SZYBALSKI and J. KUCZYNSKI. *Ibid.*, 244. (C) J. KURZEWSKI. *Ibid.*, 245–246.—(A) The double affination process suggested by SZYBALSKI and KUCZYNSKI[1] is criticized on the grounds that insufficient information was given, and that multiple and double affination leads to high losses, particularly when steam is used for washing. (B) In reply to the criticism put forward by KRAJEWSKI (above), results of experiments with double affination carried out at Strzelin factory are tabulated. In 1953, 1954, and 1955 the Brix of 3rd product sugar was 94·7, 95·5, and 96·1 respectively, the Brix of the molasses was 84·7, 84·5 and 85·3 respectively, and the colour of the sugar was 0·65, 0·50 ,and 0·49°St. respectively. No abnormal losses were noted with the use of steam for washing. (C) Results of experiments with double affination of 2nd and 3rd product sugar at Strzelin factory during the 1952–55 campaigns are discussed (see above). The 1955 results show, it is suggested, that double affination gives better results and is cheaper than chemical treatment of remelted 2nd product sugar, although superheated steam for washing is considered uneconomical. Instead a water-mist technique using a special nozzle, based on English practice, is advocated. For 2nd product centrifugals thin juice is preferred to steam, while for the 2nd product affination both thin juice and water may be used.

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The Mackintosh Mechanical Ploughs and their Tips. E. KRIEG. *Sucr. Belge*, 1957, **77**, 8–14.—Tips of various materials to be used with Mackintosh centrifugal dischargers are discussed. Fibre tips have a life of 1500–10,000 discharges (1st product), but wear mainly at the bottom corner, so that at the end of their life they leave a band of sugar, containing up to 3 kg, in the basket. Local wear is also caused by increased thickness in the perforated screen due to the intersection of two threads from the thick support cloth with two from the thin cloth. Soft wood tips have a life of 100–200 discharges, have the same disadvantages as the fibre tips, but cause less wear in the perforated screen ; Light alloy tips, 3·2 mm thick, have great elasticity ensuring no hindrance from slight irregularities in the screen surface. One particular alloy was chosen only after tests on about 40 centrifugals. These tips have a life of 50,000–100,000 discharges, representing 1–3 campaigns of 3 months each and retain their rectanglar shape. The tips must extend 23 mm beyond the supporting hood at the end of the plough arm to avoid bending or breaking. Four sizes of tips are manufactured, each having a series of holes to take the gudgeons, so that the tips can be moved forward in 6 successive positions with wear to ensure a constant overlap of 23 mm beyond the support.

* * *

A Study on Using a Wetting Agent for the Recovery of Sucrose from Bagasse. I. H. CHEN. *Taiwan Sugar*, 1957, **4**, (8), 13–17.—After preliminary tests had shown that it was possible to reduce the bagasse pol by maceration with an alkyl aryl sulphonate wetting agent, factory trials were carried out at a 1500 ton mill, using compound imbibition. Results are tabulated and show that bagasse pol can be reduced by 0·25% on an average, when 30 p.p.m. wetting agent is used, but only when the grinding rate and imbibition are constant, and the bagasse is not coarsely shredded. No mill slippage or interference with juice clarification occurred.

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Sugar Cane Milling—How to make it Better and how to Cope with an Increasing Crop. H. S. WU. *Taiwan Sugar*, 1957, **4**, (8), 18–21.—The method adopted by the Edwards Engineering Corporation to test mill performance is discussed[2], and Taiwan mill data are compared with those from Louisiana. The question of the slow milling rate in Taiwan is discussed and from comparison of the performance and costs of a 2nd tandem with those of a modified existing tandem with a faster crushing rate, it is concluded that the installation of the 2nd tandem would be very advantageous, giving greater pol extraction and a large additional profit.

* * *

Packaging 150 Bags of Sugar per Minute. ANON. *Sugar y Azúcar*, 1957, **52**, (9), 30.—The "Titeseal" continuous motion packaging machine developed by Brecknell-Dolman & Rogers Ltd. in collaboration with Tate & Lyle Ltd. is described. Capable of packaging up to 150 1– or 2–lb bags of sugar per min, the machine automatically weighs to within ± ½ dram, settles by controlled vibration, seals and discharges the bags from a dryer in rows of 4 ready for parcelling. One operator supervises the complete operation.

[1] *I.S.J.*, 1957, **59**, 316.
[2] *I.S.J.*, 1955, **57**, 390.

Calculation of Heat Economy of a Sugar Factory Based on Sugar Content of the Beet and Draught. P. MOSEL. *Zeitsch. Zuckerind.*, 1957, **82**, 261–271, 317–329.—The effect of sugar content of beet and of draught on the operation of a multiple-effect evaporator and on steam consumption of the factory is discussed. A flow sheet for a white sugar factory is given, based on data from Franken and Ochsenfurt factories and on data from the literature. The effects of change of sugar content and draught on changes in material flow and steam requirement are reviewed. Steam requirement is given by

$$D = {}^{*}D + Z_R \cdot \left(\frac{1}{\xi_4} - u\right) + e.E \text{ kg/100 kg}$$

where $^{*}D$, u and e are constants characteristic for each factory, Z_R = beet sugar content in kg/100 kg, ξ_4 = thick juice concentration, E = draught. Steam consumption for a white sugar factory is twice that for a raw sugar factory processing beet of the same sugar content. The effect on steam consumption of vapour and condensate usage is discussed.

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From the 1956/57 Campaign. F. SCHNEIDER. *Zucker*, 1957, **10**, 352–357.—Ash in thick juice amounted on the average to 2·57 per 100 pol, while molasses contained 1·65 organic non-sugars/ash, compared with figures of 3·88 and 1·36 respectively for the previous campaign. The raffinose content of molasses (on 80°Bx basis) did not alter much from that of the previous two campaigns (1·21 in 1957), though the ash content was still relatively high (11·02) and average purity was 48·8. At Bedburg factory a small belt conveyor was placed below and at right angles to the end of the belt conveyor transporting beet to the bin, to remove any rotten particles, weeds, juice, etc., and so minimize infection during diffusion. The dirt removed thus constituted 1–2% by weight of beet and contained about 2% pol. Modifications made to the screw conveyor of a 1200–1300 ton BMA tower diffuser at Meine sugar factory are mentioned, whereby the working height was reduced to 13 m from 16–18 m and greater use made of the working space within the tower. Raw juice purity from a BMA tower with waste-water return was the same as that from a fresh-water battery of 3 Oppermann & Deichmann diffusers at one factory, while tower losses were 0·2 pol compared with battery losses of over 0·6 pol on beet. A press water treatment survey shows that it is necessary to avoid stagnation and to raise the temperature to at least 75°C ; continuous depulping of raw juice in the vessels with some disinfectant addition is recommended. In one installation milk-of-lime from the slaking drum passes through two stone catchers, between which is installed a surge tank. It then goes at the rate of 2·5 cu. m./hr to two Dorr-Oliver hydrocyclones, where it is separated into sand-free and sand-rich lime. The latter is diluted with fresh or sweetening-off water and is treated in a further hydrocyclone, before being sent to the slaking drum and the cycle is repeated. Lime losses from the last-mentioned hydrocyclone are 0·027% on beet, and sugar losses with the use of sweetening-off water for dilution can be kept below 0·005%. A system of second carbonatation mud separation operates in two stages ; for the first a battery of 12 hydrocyclones capable of treating 60 cu.m. juice per hour was installed, in which 90% of the carbonates were removed, the overflow, containing 0·004% CaO, being sent to after-filtration. In the second stage two hydrocyclones concentrate the first stage underflow. The second stage underflow is returned to pre-defecation. The second stage overflow returns to second saturation. Considerable amounts of sucrose could be recovered from molasses treated at Brühl factory by exchanging the ions present for Li, Ca, and Mg cations. This effect was most marked with the Mg-molasses. When about 20% of the alkali present was replaced by Mg, final molasses purity was 3–4 points lower, sugar recovery being 0·2–0·3% on beet. A unit for compressing beet leaves or dried pulp into briquettes for animal fodder consists of four edge runners with fixed axles mounted on rotating perforated discs. The fodder is compressed into the perforations and is cut to required size of 2·5 × 3 cm by knives mounted below the discs. Moisture content of the pulp should be 12–14 %. Briquette volume is no more than 40% of the original.

* * *

Modern Planning and Construction of Sugar Factories. U. STARK. *Zeitsch. Zuckerind.*, 1957, **82**, 437–443.—The factors to be considered in the construction of beet factories and in the modernization of existing factories (i.e. water supply, communications, labour, etc.) are discussed with illustrations.

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The Composition of Beets and Juices from the 1956/57 Campaign. P. PAVLAS and O. MELOUNOVÁ-HAUSLEROVÁ. *Listy Cukr.*, 1957, **73**, 199–205.—Full details are given of the composition of the beets and juices from Czechoslovakian factories during the 1956/57 campaign. The purity of diffusion and thick juices was low, due to the presence of greater amounts of alkaline and organic non-sugars, nitrogenous compounds being especially prominent. A high amide content caused a drop in alkalinity during evaporation and a high lime salts content in the thick juices. An above-average purification was effected in the case of the N-non-sugars, but in the case of the other non-sugars, the reverse was true, and consequently the purity of the thick juices was low and the molasses yield high.

New Books and Bulletins

Absorption Spectrophotometry. 2nd Edn. G. F. LOTHIAN. 246 pp ; 5½ × 8½ in. (Hilger & Watts Ltd., 98 St. Pancras Way, London N.W.1.). 1958. Price : 52s. 0d.

Absorption spectrophotometry has advanced very greatly since the first edition of this work in 1949. Consequently the author has had to re-write virtually every chapter to include the new material and sources of information as can be judged by the present bibliography and author index. As before, there are three sections dealing, respectively, with principles and laws, applications and techniques. A useful aid is the system of cross-references between the sections to enable readers unfamiliar, say, with instrument practice to follow problems arising in the application of theory. A number of books and reports are also recommended for further reading.

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Methyl Glucoside—Preparation, Physical Constants, Derivatives. G. N. BOLLENBACK. 183 pp ; 6 × 9 in. (Academic Press Inc., 111 Fifth Avenue, New York 3, N.Y., U.S.A.). 1958. Price : $5·50.

This work comprises four parts ; a short introduction, 12 pages describing the occurrence of methyl glucoside, 36 pages describing the physical constants of the furanoside and pyranoside forms, and no less than 113 pages devoted to the derivatives which have been isolated since Fischer's synthesis in 1893. To the research chemist this work will be an invaluable reference book since it contains constants, preparative descriptions, and as complete a review as possible of the literature up to and including 1956. In addition there are some more recent references, and certain previously unpublished information. The subject index covers 26 pages.

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Process Engineering in the Food Industries. R. J. CLARKE. 355 pp ; 5¼ × 8½ in. (Heywood & Co. Ltd., Kinsgway, London W.C.2.) 1957. Price : 60s. 0d.

The author deals with a wide range of unit operations—liquid flow, heat exchange, liquid filtration, evaporation, crystallization, drying, etc.—many of which are applicable to the sugar industry. In each he discusses first the general principles concerned, developing and explaining the use of certain of the theoretical rules and formulae governing rates, power requirements, etc., and then passes to a description of the types of equipment available for carrying out the operation. Finally he gives a short account of the equipment used in individual food industries for the operation. In the references to the sugar industry, his accounts are necessarily simplified but are basically accurate except for minor errors such as the spelling "cosettes" in several places. It is strange to see a cane mill used as an illustration for a roller mill but with no reference to cane crushing in the text. The book is an excellent guide to chemists and engineers entering the food industry and also to those whose task it is to improve their own methods as can sometimes be done by borrowing the technique of an allied process industry.

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The Scaling-up of Chemical Plant and Processes. 136 pp ; 8¼ × 10½ in. (Institution of Chemical Engineers, 16 Belgrave Square, London S.W.1.). 1958. 60s. 0d.

The Institution of Chemical Engineers, Society of Chemical Industry, Het Koninklijk Institut van Ingenieurs and De Koninklijke Nederlandse Chemische Vereeniging held a joint symposium on scaling-up in London during May 1957. The present volume is a record of the papers read at the symposium and the discussions arising. While no paper had a direct sugar bearing, many contain material which is of general interest, for example in economic aspects, stirred slurry reactors, continuous filtration, etc., which will be of considerable interest to sugar men concerned with this aspect of chemical engineering.

* * *

Heat Transfer. Vol. 2. M. JAKOB. 652 pp; 5¾ × 9 in. (Chapman & Hall Ltd., 37 Essex Street, London W.C.2.). 1957. Price : 120s. 0d.

The second volume of the late Dr. JACOB'S work completed by S. P. KEZIOS, deals mainly with selected fields of heat transfer applications and also with heat radiation in spaces of simple configuration. Applications which concern the sugar industry include those of thermometry and pyrometry, ordinary heat exchangers (recuperators), regenerators, cooling towers and the cooling of surfaces exposed to hot gases, as in boilers, etc. In each case, the subject is treated mathematically in a thorough manner, with copious references to a bibliography which occupies 19 pages at the end of the book. A special feature is the inclusion of a series of supplements to the first volume, while another appendix gives a series of problems to be worked out ; nomenclature and symbols, and conversion factors are also included, as well as the subject index which is intended for locating special items and topics.

LABORATORY METHODS AND CHEMICAL REPORTS

Investigations of the Metabolism of Beet Attacked by Virus Yellows under East German Conditions. E. SOMMER. *Zeitsch. Zuckerind.*, 1957,**82** , 387–393.—Investigations of the changes caused in beet by virus yellows were carried out in 1954–56. The amount of reducing sugars present in press juice from the infected beets was 6–12 times greater than in juice from healthy beets, while the disaccharide (mainly sucrose) content was only moderately increased. Reducing sugars content of the infected beet leaves was considerably increased and the electrical conductivity of the infected beet increased. About 18 days after infection the N content of the root increased while the total N and albumin–N in the leaf decreased, and noxious N and betaine increased. Amylase and β–h–fructosidase activity in the earlier infection groups was reduced. Catalase activity increased slightly in both leaf and root, while phosphatase activity fell sharply a few days after infection. No qualitative differences in amino acids content was detected. Investigations into the pectins and nucleic acids content are continuing.

* * *

Amino Acids Participating in the Formation of Melanoidins. P. PAVLAS and O. MELOUNOVÁ–HAUSLEROVÁ. *Listy Cukr.*, 1957, **73,** 177–182.—Melanoidins were isolated from raw beet sugar factory and refinery molasses of 15°Bx by dilution, acidification with HCl, and salting-out by saturation of the liquor with solid Na_2SO_4. The precipitated colouring matter was separated, washed, and dried, then purified by extraction with ether and alcohol, and dissolved in pure NaOH. It was then precipitated with HCl, washed and dried. Samples were precipitated in various ways from Li_2CO_3 solution, e.g. with acetic acid, and gave 12 fractions, of which the dry solids, ash, and N contents are tabulated. The fractions were hydrolysed with acid or alkali and the following amino acids detected by paper chromatography and electrophoresis : aspartic and glutamic acids, serine, glycine, threonine, alanine, γ-aminobutyric acid, methionine, tyrosine, lysine, histidine, arginine, proline, valine, tryptophane, phenylalanine, leucine, isoleucine, ornithine, and cystine. It is assumed from this that not only amino acids, but also polypeptides and simpler proteins and their chains are condensed with the reducing sugars in the Maillard reaction with the formation of molecules of various sizes.

* * *

Improvement in the Complexometric Method of Determining Calcium in Sugar Industry Products. A. K. KARTASHOV, N. A. MAKSIMOVA, and R. G. ZHIZHINA. *Sakhar Prom.*, 1957, (9), 54–58.—Determination of the end point in the complexometric titration method of Ca determination is discussed, and a photoelectric method described and illustrated. To 25–50 ml of 2nd carbonatation juice made up to 100 ml with distilled water is added 2 ml 10% sodium sulphide and 10 ml 1*N* caustic soda solution. After addition of 0·25 g murexide indicator, the solution is titrated with standard "Trilon" solution, a magnetic stirrer being used for agitation. A selenium photo-cell element is used in connexion with a 650 mV galvanometer, a 12 volt car headlamp being used as light source. The results of three tests are shown, both oxalate and complexometric method being used for each test. The difference between the two methods was very slight (within 1 mg of CaO per 100 ml juice), while juice colour had no effect on the accuracy.

* * *

Apparatus for White Sugar Colour Determination. ANON. *Gaz. Cukr.*, 1957, **59,** 214–215.—The apparatus comprises a rotating drum containing polarimeter tubes filled with standard and unknown sugar solutions, and an eyepiece with two prisms (as in the Stammer instrument). The procedure is similar to that adopted with the Hellige comparator. Disadvantages are enumerated.

* * *

Quantitative Determination of Carbohydrates in Sugar Industry Products with Paper Partition Chromatography. G. S. BENIN and N. A. DERBENTSEVA. *Sakhar. Prom.*, 1957, (9), 58–61.—Chromatographic analysis of sugar solutions is discussed and a method of quantative determination described. After separation of the sugar solution by descending chromatography using *n*-butanol:ethanol as solvent and developing with α-naphthol, the separated sugars are extracted by elution[1], and anthrone reagent added. After heating for 10 min in a hot water bath and cooling to 20°C, the colour density is measured at 620 mμ. A simpler process is described, whereby raffinose spots were extracted with distilled water, the anthrone then being added.

* * *

Continuous Counter-Current Diffusion of Beet Sugar. H. H. YANG. *Dissert. Abstr.*, 1957, **17,** 1290; through *J. Sci. Food Agric. Abs.*, 1958, **9,** i 209–210.—Sugar beets were processed at 65–75° in a continuous counter-current diffuser, with 1·0–1·2 lb of diffusion water per lb of beet. A comparative study between the normal continuous process and the continuous process with $Al_2(SO_4)_3$-treated cossettes, and batch processes was made. Sugar diffusion rates under various operating conditions were correlated in terms of the fractional extractable sugar content of beet as a function of diffusion water rate, temperature and diffusion time. The semi-batch diffusion method proved a simple but efficient experimental procedure to study.

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Colorimetric Determination of Saponin as found in Beet Sugars. H. M. BAUSERMAN and P. C. HANZAS. *J. Agric. Food Chem.*, 1957, **5,** 773–776; through *J.*

[1] DENT: *Biochem. J.*, 1947, **41,** 240.

Sci. Food Agric. Abs., 1958, **9**, i 210.—In the extraction from sugar (100 g samples) the saponin was precipitated with HCl, freed from fat with hot benzene and dissolved in hot methanol. This extract (5 ml) was made up to 10 ml with conc. H_2SO_4. Transmittance was measured at 575 mμ and again after addition of 0·25 ml of α-naphthol (10% in methanol); 0–12 mg of saponin was found. The method was also tested by using 100-g portions of sugar, dissolving, acidifying, filtering and adding known amounts of saponin to the filtrates. Data indicate the efficiency of recovery.

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Determination of 2:2-Dichloropropionic Acid ("Dalapon") in Sugar Cane. G. N. SMITH, M. E. GETZENDANER and A. H. KUTSCHINSKI. *J. Agric. Food Chem.*, 1957, **5**, 675–678; through *J. Sci. Food Agric. Abs*,. 1958, **9**, i 210.—Residues of "Dalapon", if present in sugar-cane juice, are extracted with ether, and isolated chromatographically. The dichloropropionic acid is then converted into pyruvic acid and determined colorimetrically as its 2:4-dinitrophenylhydrazone. In artificially fortified samples, recovery was about 78% with a 0·1 p.p.m. sensitivity. No residual "Dalapon" was observed when the maximum recommended dosage of 3·7 lb/acres of sugar cane was applied on a row basis, or even 1·4 times the maximum (5·2 lb per acre), an indication of safety in use.

* * *

Paper Chromatography of Amino-Acids, Sugars and Acids. G. HÖGSTRÖM. *Acta Chem. Scand.*, 1957, **11**, 743–745; through *J. Sci. Food Agric. Abs.*, 1958, **9**, i 232.—Methyl ethyl ketone with acetone, water, and formic acid is proposed as a new solvent for paper chromatographic separation of amino-acids, sugars and organic acids.

* * *

The Lead Error in the Polarization of Raw Cane Sugar. K. DOUWES DEKKER. *Comm. Sugar Milling Res. Inst.* (Natal), 1957, (36), 22 pp.—The confusion arising from the use of the Ventzke and International sugar scales and from the use of wet and dry lead clarificant are reviewed, and recent work on correction errors discussed. South African work to examine the corrections proposed by EYNON *et al.*[1] is described; they are found to be inapplicable to South African raw sugars. Results of the investigation are in agreement with the recommendations made by the London meeting of analysts[2] to use wet lead only for polarization of raw sugar.

* * *

The Kinetics of the Disappearance of Reducing Power of Alkaline Glucose Solutions. R. PIECK. *Rpt. Lab. J. Dedek* (Tirlemont), 1956, (1), 110 pp.—Glucose solutions were maintained at various temperatures from 50° to 95° and at pH values of 8·4 to 11·4. Samples were withdrawn at intervals, immediately cooled to 20° and neutralised to pH 7. The reducing sugars concentration was determined by Spengler's method[3] (adapted for semi-micro analysis by G. RENS) and by electrolytic and gravimentric quantitative determinations of precipitated Cu_2O. The reaction was found to be of the first order. Results are tabulated and graphs given of pH *vs.* alkali added and of the velocity constant k_1 of the glucose degradation relative to the NaOH added, for the temperatures used. Increasing temperature had a marked effect on the reaction, an increase of 10°C trebling the reaction rate. The results of all the tests are also expressed in the form of a nomogram.

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Study of Solubility of Calcium Iodate in various Solutions of Electrolytes. G. RENS. *Rpt. Lab. J. Dedek* (Tirlemont), 1957, (2), 33 pp; (3), 22 pp.

In a study of the Ca^{++} ion activity in solutions containing hexose degradation products in alkaline media and, finally, in sugar factory juice, the solubility of $Ca(IO_3)_2$ was determined at 20°C in aqueous solutions of LiCl, BaCl, KCl, KBr, KI, NH_4Cl, $CaCl_2$ and $MgCl_2$, and in solutions of NaCl + sucrose, The iodate was determined by the usual method of semi-micro analysis, viz., addition of KI and titration with $Na_2S_2O_3$, and the Ca was determined complexometrically. Full details of the complexometric method are given. Anomalies were found with the KI solutions as a result of the reaction of the I^- ions with IO_3^- ions, which increased the solubility of the calcium iodate. Sucrose had no effect on the solubility of the iodate in NaCl, even at 0·4M concentration. Calculations are given for solubility products, and formulae for the activity coefficient of the $Ca(IO_3)_2$ in terms of ionic strength given for solutions of different concentrations, and for the solubility product in molar concentration.

The solubility of $Ca(IO_3)_2$ was measured in solutions (at 0·0–0·2 ionic strength) of: KNO_3, $Ca(NO_3)_2$, KIO_3; sodium formate, acetate, lactate, gluconate and glutamate; ammonium acetate; lithium lactate; and calcium gluconate. Graphs show the relationship between the activity coefficient and ionic strength, a relationship which varies considerably with the nature of the co-solute. Graphs are also given of the calculated parameter relating to the minimum approach distance of the solute and co-solute ions *vs.* ionic strength. The curves vary with the nature and especially with the concentration of the co-solute. Several values of this parameter are impossible, in fact, because they are too low, zero, or even negative. Hence the assumptions underlying the theory, viz., that there is complete dissociation of both solute and co-salute; that no ionic associations exist; and that the first approximation of the Debye-Hückel theory can be applied, are insufficient to explain quantitatively the behaviour of the iodate in the presence of the co-solutes. Other assumptions are to be made in future re-examinations of the various electrolytes.

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The Chemical Laboratory Report. G. W. GREENWOOD. *Sugar J.* (La.), 1957, **20**, (5), 14–15, 35.—The basic requirements of a good report form are discussed.

[1] *I.S.J.*, 1954, **56**, 100; 1955, **57**, 7.
[2] *I.S.J.*, 1957, **59**, 156.
[3] *Z. Ver. deut. Zuckerind.*, 1936, **86**, 130, 322.

BY-PRODUCTS

Extraction of Wax from U.S. Sugar Cane Mud. J. Dominski, J. J. Spadaro and H. L. E. Vix. *Sugar J.* (La.) 1957, **20,** (2), 17, 38.—The filtration-extraction process devised for the extraction of oil from oil-seeds[1] has been found suitable for extraction of wax from Louisiana muds containing 7% of wax. Extraction efficiencies of 83–85% were obtained with heptane, and the muds had mass velocities as high as 5900 lb/hr/sq. ft.

* * *

Raw Sugar in the Rations of Growing-Fattening Swine. C. B. Singletary, K. G. Coulon and G. L. Robertson. *Sugar Bull.*, 1957, **35,** 262–264.—Pigs fed from 60 to 200 pounds utilized a ration containing up to 30% of raw sugar, with satisfactory results from the standpoint of gain and feed efficiency and carcass quality.

* * *

Studies on Ammoniated Molasses. III. Feeding of Ammoniated Cane Molasses to Livestock. J. R. Howes, M.G. Lines and L. F. Wiggins. *Proc. B.W.I. Sugar Tech.*, 1955, 103–108.—It was established that small M.W. pyrazines and imidazoles are likely to be responsible for the toxic properties of ammoniated molasses, and that the addition of sufficient quantities of acetic or phosphoric acid to ammoniated molasses fed to ruminants has beneficial effects in that palatability is improved and no undesirable toxic symptoms are encountered. In a digestibility trial using sheep and goats fed with ammoniated inverted molasses, it has been shown that the digestibility of the dry matter, crude protein and crude fibre is depressed but that the digestibility of the crude protein fed to goats was considerably enhanced by addition of ammoniated molasses.

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Ammoniation of Bagasse. R. W. Temple and L. F. Wiggins. *Proc. B.W.I. Sugar Tech.*, 1955, 108–112.—See *I.S.J.*, 1956, **58,** 9.

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Recent Progress in By-Products Development. A. R. Ruíz. *Sugar J.* (La.), 1957, **20,** (3), 50, 52.—Current and projected enterprises for production of cane wax ; yeast ; pulp, paper and board from bagasse ; dextran and "Sequlene"[2]; dehydrated molasses, etc. are reviewed.

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Levulose and Dextran—Cuba Studies Sugar Derivatives. E. L. Symes. *Sugar J.* (La.), 1957, **20,** (3), 69.—Literature on the nutritional value of levulose is briefly reviewed, and mention made of a process under study at Central España, which ferments sucrose with *Leuconostoc* to give dextran, the residual product being a levulose syrup.

New Process Control Applications in Fermentation. G. J. Fuld and C. G. Dunn. *Ind. Eng. Chem.*, 1957, **49,** 1215–1220.—Sugar concentration falls during a fermentation with production of baker's yeast, so causing a decrease in refractive index of the medium, which decrease is also affected by a number of factors including the quantity of alcohol produced and the accumulation of non-metabolizable fractions. A possible means of automatically correcting for this decrease to enable automatic control of the process is described and discussed.

* * *

Citric Acid Production by Submerged Fermentation. M. Martin. *Ind. Eng. Chem.*, 1957, **49,** 1231–1232.—The fermentation was found to be sensitive to sterilization conditions and sterilization at 15 p.s.i. was found to be better than at atmospheric pressure and as good as at higher pressure. Best yield and production rate were obtained with an inoculation rate of 280,000 pellets per litre[3]. Yield of acid increased with gas flow, sharply (50%) over 200 to 300 ml/fermenter/min, 12% over 300 to 500 ml, and 8% over 500 to 1200 ml. Optimum temperature was 31°C and pH 7·0. Addition of phosphate was found undesirable, while the ferrocyanide addition had an optimum level varying from molasses to molasses. Yields decreased sharply on either side of this optimum.

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Wax Extraction from Wet Filter Mud. R. Deicke. *Proc. 24th Conf. Queensland Soc. Sugar Cane Tech.*, 1957, 115–125.—Extraction tests were carried out with the 1955 batch extractor modified to improve solid–liquid contact. The results are tabulated and discussed. The optimal rate for Shell X2 solvent addition was 5–10 gal/hr for 50 lb of mud, to which water was added to give an adequate moisture content. Agitation was of great importance and was found to be the major rate-controlling process. Best extraction (93% after 4½ hr) is obtained from wet filter mud (80% moisture) at a temperature of 50–80°C, although with primary mud, the emulsification caused by the relatively high degree of agitation prevents efficient extraction. Further experiments with a continuous process are suggested in which attention could be paid to both extraction and solvent recovery.

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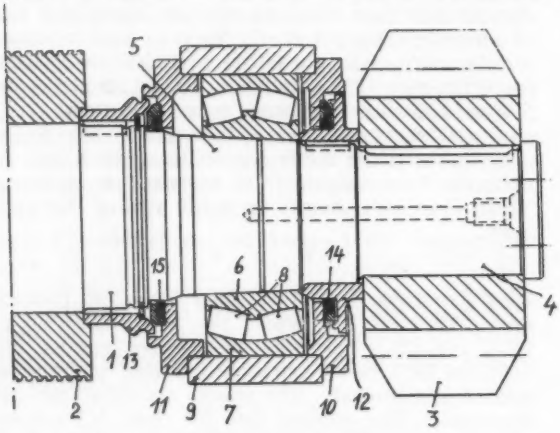
Sugar as Raw Material. V. Prey. *Zeitsch. Zuckerind.*, 1957 **82,** 444–450.—The use of sugar as raw material in the chemical industry is reviewed with 61 references to the literature. Derivatives particularly discussed include the fatty acid esters, lactic and aconitic acids, and monosodium glutamate.

[1] *Ind. Eng. Chem.*, 1953, **45,** 247-254 ; *Soybean Digest*, 1956, **16,** (12), 18-20.
[2] *I.S.J.*, 1957, **59,** 328.
[3] Cf. *Ind. Eng. Chem.*, 1952, **44,** 2229-2233.

UNITED KINGDOM

Roller Bearings for Cane Mills. GUTEHOFFNUNGSHÜTTE STERKRADE A.G., of Oberhausen/Rhld., Germany. **792,362.** 2nd April, 1954 ; 26th March, 1958.—The roller 1 and shell 2 extend to a journal 4 supporting a coupling cog wheel 3. In an intermediate position, however, the roller is supported by a roller bearing around the slightly conical intermediate journal 5. The bearing comprises an inner race 6 provided with a correspondingly conical bore ; an outer race 7 and two rows of rollers 8. The outer race 7 is held by a housing 9 and the bearing is closed by covers 10, 11 connected to the fixed bearing housing



and by labyrinth bushes 12,13 revolving with the roll and provided with packing rings 14, 15. The nominal mean diameter and taper of the conical bore of the inner race 6 are so chosen that when the inner race is forced through a predetermined distance from the point on the journal 5 at which the conical bore at its larger end, is in complete circumferential contact with the journal, the inner race is expanded and grips the journal with sufficient force to secure and seat it upon the journal. At this point, the radial clearance between the rollers 8 and the inner and outer races of the bearings must not exceed or fall below a predetermined maximum or minimum limit, respectively. The tolerance limits are determined in accordance with the required running conditions of the bearing. The clearance in the bearing is reduced, when the bearing is in its correct position, by an amount equal to 0·7 (d—d′) where d is the diameter of the journal at a point level with the end of the inner race when properly seated, and d′ is the diameter of that end of the inner race.

Electrodialysing Liquids. IONICS, INC., of Cambridge, Mass., U.S.A. **792,623.** 26th April, 1955 ; 2nd April, 1958.—The concentration of an electrolyte solution (e.g. raw cane juice) is changed by passing it as a feed solution through dilution chambers of an electrodialysis unit having alternating dilution and concentration chambers formed between alternating anion-permeable and cation-permeable membranes. A second feed stream (e.g. water) is passed through the concentration chamber in parallel to the first and flow rates maintained so as to subject the membranes to substantially equal pressures on each face. A direct current is passed in series across the alternating chambers and membranes (so causing ionised ash constituents to pass through the membranes from the cane juice into the water streams). Part of either or both streams may be recirculated.

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Beet Harvesters. (1) C. J. STEKETEE, of 11 Korteweg, Driewegen, (Z.B.), Holland. **792,902.** 27th December 1956 ; 2nd April, 1958. (2) J. M. REEKIE, of Arbroath, Angus, Scotland. **792,929.** 28th February 1957 ; 9th April, 1958.

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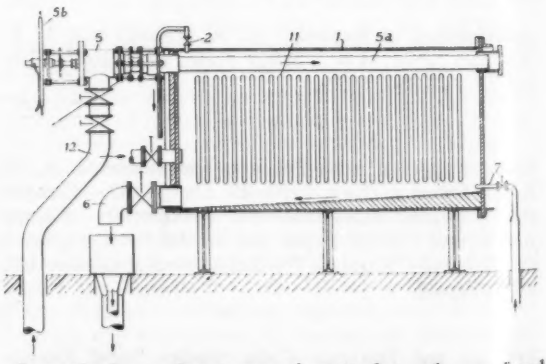
Filter Press. R. SZAREJKO, of Warsaw, Poland. **793,476.** 24th February 1956; 16th April 1958.—A cylindrical tank 1 contains a number of leaves 11 connected to an exit pipe. Beet juice admitted to the tank is filtered, the muds collecting on the cloths surrounding the leaves. When the spaces between the leaves are filled with mud, the juice flow is stopped and water passed into the tank to sweeten-off the mud. When this is completed the muds are removed



from the leaves by sprays of water from the overhead pipe *5a* which may move to a limited extent along the axis of the filter under the action of handwheel *5b*. The muds are removed from the filter by sprays

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of water delivered by pipe 7 which cause them to flow to the mud exit pipe 6. The appropriate valves are closed and opened and juice flow re-started. Hence the press does not need to be stripped down for cleaning with consequent saving in space.

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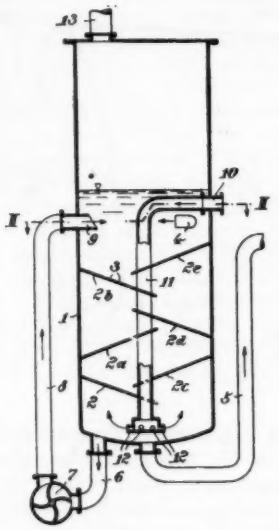
Saturation of Sugar Juices. MASCHINENFABRIK BUCKAU R. WOLF A.G., of Grevenbroich, Germany. **795,148.** 25th March 1955; 14th May 1958.—Juice enters the carbonatation equipment 1 by means of a tangentially directing pipe 4 and passes downwards in counter current to a supply of CO_2 entering the vessel through pipe 10 and distributor 12. Perforated baffles 2, 2*a*, 2*b*, 2*c*, 2*d*, 2*e* promote efficient mixing



of the gas and juice and unused gas and vapour pass up and out of the chamber by way of pipe 13. Some of the carbonatated juice passes out of the vessel 1 by way of pipe 5 and passes either to a further carbonatation unit or filter. However, the bulk of the juice is recirculated through pipes 6 and 8 under the action of pump 7, so mixing with the incoming juice.

* * *

UNITED STATES.

Apparatus for Measuring the Degree of Supersaturation of Boiling (Sugar) Solutions. T. R. HARRISON, assr. MINNEAPOLIS-HONEYWELL REGULATOR CO., of Minneapolis, Minn,. U.S.A. **2,813,419.** 12th November, 1954; 19th November, 1957.—An apparatus and circuit are described for measurement of supersaturation as a function of boiling point rise between solvent and solution.

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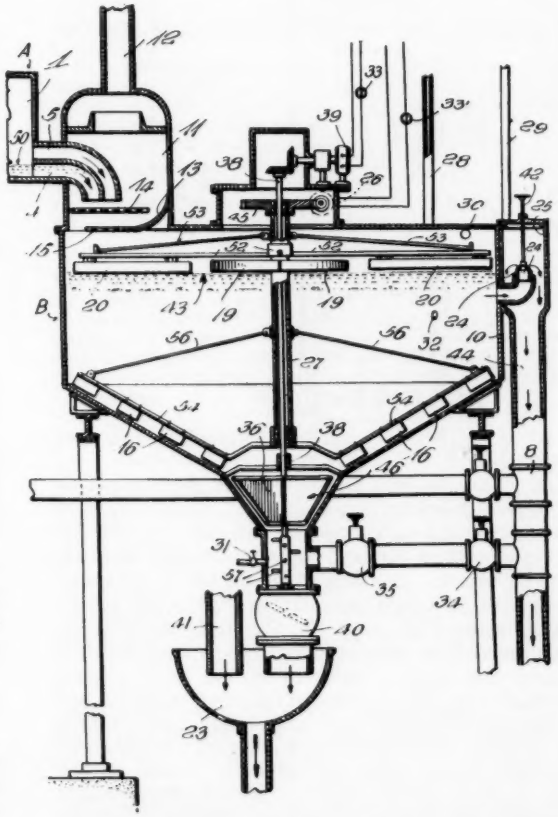
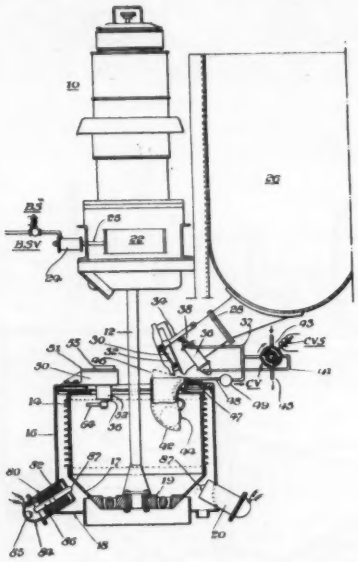
Preclarifier for Separating Solids and Liquids. F. SALDAÑA DAVILA, of Bayamon, Puerto Rico. **2,821,306.** 7th February 1955; 28th January 1958.—Juice to be clarified passes into a horizontal cylindrical chamber *A* (only the end of which is shown) and is partly separated into one stream which goes to main clarification and to two further streams the first, containing the heavier particles, leaving *A* by conduit 4 and the second, containing the scum and lighter particles, leaving by conduit 5. These conduits discharge into the sedimentation chamber *B* which comprises a cylindrical tank with a frustroconical base. The conduits discharge into the entrainment separator chamber 11 where they enter past baffles which prevent splashing. Scum on the surface inside the preclarifier is removed by means of helicoidal bands 19 and scrapers 20 supported on radial spokes 52 which push the scum into a discharge trough (not shown) which feeds via pipe 41 into the combined sediment and scum trough 23. The spokes 52 are carried on the driven hollow shaft 27 which also carries spokes 56 supporting scraper arms 54. The



scrapers 16 send the muds to the concentrator 46 where they are kept agitated by either a screw or staggered lugs 57 so that they are kept in such a condition that they may be readily discharged through valve 35 and the discharge pipe. The lugs are mounted on shaft 38 which is separately driven and is located inside the hollow shaft 27. Preclarified juice leaves the tank by way of outlets 24 into pipe 25, the level of the juice in the tank being governed by screw control 42.

Fully Automatic Centrifugal. E. C. MASSON, of Miami, Florida, U.S.A. **2,822,092.** 27th March 1951; 4th February 1958.—Massecuite contained in the mixer tank 26 is discharged through loading gate 30 which is operated pneumatically by compressed air admitted to the bottom and top of cylinder 36. The massecuite is directed onto the wall of the basket by means of funnel 42 which has an inflatable element 44 connected to the pipe 37 leading to the top of cylinder 36. Air is admitted by way of the 3-way control valve *CV* to pipe 41 when the gate opens, pipe 36 being vented to atmosphere. When the valve position is altered pipe 41 is vented and pressure is admitted to pipe 37



which closes the gate 30 and inflates the element 44 to prevent dripping of massecuite. Check valve 49 ensures that the period before inflation is sufficient to allow most of the contents of the funnel to drain into the basket. Loading of the basket is governed by a probe 64 which rests on the wall of the basket and is rotated with respect to the stationary housing 52 as the wall of sugar builds up to a point where it actuates the control which closes the loading gate. The basket has no bottom and the sugar is discharged by vibrators 20 which strike the basket rapidly with the plungers 87, so loosening the sugar which falls onto the smooth solid conical walls 17 and so out of the machine. Braking is also achieved pneumatically by control *BSV* which operates the cylinder governing the friction brake 22. The loading, running, braking, discharging, etc., are all automatically time-controlled.

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Sugar Treatment. D. W. GILLMORE, R. J. GRANT and S. B. SMITH, assrs. PITTSBURGH COKE & CHEMICAL CO., of Pittsburgh, Pa., U.S.A. **2,822,304.** 29th March 1956; 4th February 1958.—A cane sugar solution is decolorized and purified by passing through a column containing a mixture of bone char or granular or other active carbon with dead-burned magnesite in sufficient quantity [1–15% (5–10%) by weight on carbonaceous material] to control the pH of the solution. After 8 days on stream the mixture may be regenerated for re-use. The magnesite particles are approximately the same or of smaller size than the carbonaceous particles.

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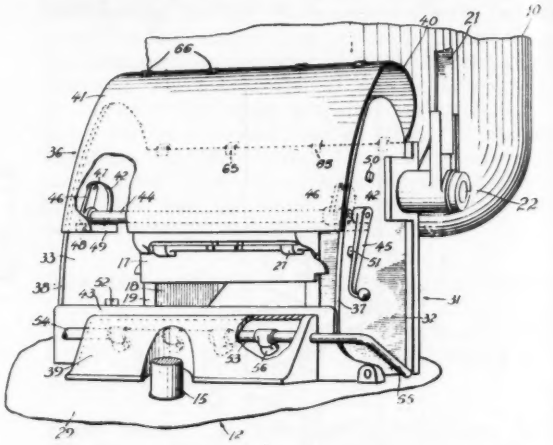
Sugar Centrifugal Charging Apparatus. J. HERTRICH, assr. THE WESTERN STATES MACHINE CO., of Hamilton, Ohio, U.S.A. **2,823,805.** 15th August 1952; 18th February 1958.—Sugar from container 10 is delivered into the basket by way of gate 18 which is opened and closed by the movement of plate 17 along the



sliding faces 19 under the action of arm 21 which rotates about axis 22. The gate is bounded by plates 37, 38 and a sectioned cover, hinged at 65 and 66 can move downwards to enclose the assembly, being held by the action of toggle springs 42. The toggle action is broken by handle 45 and the cover may be held in the up position by abutting members 50, 51. Cleaning of the gate and the inside of the cover effected by means of water or steam sprays 56 which can be moved by rotating the pipe 53 by means of its arm 55.

* * *

Fondant and Dry Fondant Sugar Product and Method of Manufacture. E. C. GILLETT and R. N. PRINCE, assrs. CALIFORNIA AND HAWAIIAN SUGAR REFINING CORP., of San Francisco, Calif., U.S.A. **2,824,808.** 10th June 1955; 25th February 1958.—A sucrose solution containing 10–40% of dextrose and levulose (20% of each) as non-crystallizing substances (which may be produced by partial inversion of a pure sucrose solution) is concentrated at 260°–300°F to a solids content of 90–95% and is mixed with 30–70% of finely disintegrated sugar particles not greater than 40 microns (25μ) in diameter and the mixture agitated violently during which particles of recrystallized sucrose (of 25μ diameter or less) are formed which, with the disintegrated sugar particles, are bonded together in agglomerated groups by links of uncrystallized dextrose and levulose. The mixture is subsequently reduced to 2% moisture content and finally comminuted to the desired particle size.

TRADE NOTICES

Statements published under this heading are based on information supplied by the firm or individual concerned. Literature can generally be obtained on request from the address given.

Suma Pipe Line Mixer. Sugar Manufacturers' Supply Co. Ltd., 7/8 Idol Lane, London E.C.3.

This unit is designed for replacement of an existing length of a pipe-line and contains no moving parts so as to reduce maintenance and power demand. A minor stream is introduced by a pipe which is located just before a distributor cone. This directs both major and minor streams to the periphery where they are split into secondary streams which enter a number of helical channels around a solid central shaft, alternate channels being in alternate directions so that the streams intersect at a large number of points which depends on the length of the unit and the number of channels. The external diameter of the unit is larger than that of the rest of the piping so as to ensure that the combined area of the channels is equal to that of the rest of the pipe line and the pressure drop will thus be minimized. Recommended time of contact is 5 seconds and efficiency of mixing is claimed to be 97–100% as determined by conductivity measurement of samples taken simultaneously from 3 channels in which salt solution was being mixed with water. The unit is recommended for mixing of milk of lime with raw juice ; gassing of juice ; blending of syrups; dilution of molasses for distilleries; boiler feed treatment, etc.

* * *

Knitmesh Entrainment Separation. KnitMesh Ltd., 36 Victoria Street, London S.W.1.

KnitMesh is not to be confused with woven wire as it is made from one or two separate threads interlocking in a linked loop structure giving an asymmetrical mesh. It is manufactured in a stocking shape and can be of most metals and most plastics. KnitMesh has both a large surface area and up to 95% free space. It is light in weight in relation to its volume, and can be compressed to any desired shape keeping all its properties, including resiliance. It is inexpensive and has found application in a wide variety of uses including air filters, liquid filters and entrainment separators for which last purpose it has been applied in a Mauritius factory and at a Tate & Lyle refinery.

PUBLICATIONS RECEIVED.

SALA VALVES. Nelco Processes Ltd., Ashford, Middx.

The Sala valves are designed especially for pulps and slurries and present a round hole at all ports down to a very small part of the full area and giving a Venturi-type flow pattern. A very thick rubber wall gives high abrasion resistance and negligible maintenance costs.

* * *

CANE KNIVES. George Fletcher & Co. Ltd., Derby.

A new leaflet illustrates and describes the Fletcher cane knives, their blades, clamp holders, bearings, coupling drive and method of adjustment.

SMITH INTERMEDIATE CARRIERS. A. & W. Smith & Co. Ltd., 21 Mincing Lane, London E.C.3.

A new leaflet, Publication No. ICA 57, describes and illustrates the Smith "apron-type" intermediate carrier, reviewing its advantages, including a high-level collecting end ; "Quicklift" carrier removal, and driven nose shaft.

* * *

FLUID MIXING. L. A. Mitchell Ltd., 27 Peter Street, Manchester 2.

Leaflet MX6 describes and illustrated the range of standard mixers which are available with propellors, discs, turbo-impellers or paddles and range from the portable high-speed type to heavy-duty industrial mixers.

* * *

MASSEY FERGUSON SPRAYERS. Massey-Ferguson Ltd., Coventry.

Four tractor-mounted sprayers are described in this leaflet which gives details and illustrations of the 720 low volume equipment which has a 30-gal tank and an application rate of 5 to 20 gal/acre through hinged spray booms with adjustable spray height and spray width of 16½ ft; the 719 and 721 low volume equipment which have a 45-gal tank and 60-gal tank respectively and spray over a width of 19½ ft; and the 723 medium volume sprayer which handles spray requirements from low volume work up to nearly 90 gal/acre.

* * *

101 DIFFERENT TYPES OF GRAB. Priestman Brothers Ltd., Holderness Engineering Works, Hull.

Among the 101 different types of grab illustrated in a new leaflet are a grapple for dealing with sugar cane from heaps; a multi-rope grab for sugar beets, of one ton capacity; and a number of general purpose grabs suitable for use in handling bulk sugar.

* * *

THE BTD-20 TRACTOR. International Harvester Co. of Great Britain Ltd., Harvester House, 259 City Rd., London E.C.1.

The new big IH crawler tractor, to be made in the U.K., employs a 124 b.h.p. Rolls-Royce engine with a six-speed full-reverse transmission which means that unusually high reverse speeds are available, permitting more rapid operation.

* * *

Large Cane Car Order. U.S.I. International, a division of U.S. Industries Inc., has placed orders in Belgium to the value of $2·5 million for sugar cane cars for use in Latin America.

* * *

Honeywell Controls Ltd.—This is the new name of the former Honeywell-Brown Ltd., which has also moved to new offices in Ruislip Road East, Greenford, Middlesex.

* * *

Programme-Controlled Centrifugal.[1] VEB Maschinenfabrik Sangerhausen, of East Germany, have introduced a programme-controlled white sugar centrifugal with a diameter of 1·25 m (49·2 in) and having a load of 500 kg. It has an output of 10 to 15 charges per hour and operates at three speeds—225, 485 and 960 r.p.m. Control is either manual or automatic so that charges can be worked individually or continuously. The automatic sequence includes filling, operation of the cover, brake, plough, syrup separation and steam and water washing. Extension of the range of machines up to 650 kg capacity and up to 1450 r.p.m. is under development.

[1] *Brit. Chem. Eng.*, 1958, **3**, 259.

WORLD FREE MARKET REQUIREMENTS FOR THE CALENDAR YEAR 1958

The International Sugar Council noted at its last meeting on 22nd April, 1958[1], that the estimates of world free market requirements prepared by its Statistical Committee had increased to 5,610,000 metric tons, raw value. Details of the estimates are as under.

COUNTRY OR AREA—		*Total Requirements (in thousands of metric tons raw value)*
UNITED KINGDOM and BRITISH COMMONWEALTH (excluding Pakistan)—		
Parties to Commonwealth Sugar Agreement—		
United Kingdom (total consumption)	2,740	
New Zealand (partial import requirements)	75	
Rhodesia and Nyasaland (partial import requirements)	45	
		2,860
Commonwealth Countries not parties to Commonwealth Sugar Agreement—		
Aden and adjacent territories	30	
British East Africa and Zanzibar	80	
Canada (total consumption including 12,000 tons sugar equivalent of fancy molasses)	795	
Ceylon	180	
Channel Islands	3	
Gambia/Sierra Leone	10	
Ghana	44	
Gibralta/Malta/Cyprus	30	
Hong Kong	65	
Malaya/Singapore	250	
New Zealand (balance of import requirements)	35	
Nigeria	65	
Sarawak/Brunei/British North Borneo	20	
Rhodesia and Nyasaland (balance of import requirements)	15	
		1,622
		4,482

	Estimated Supplies Available	
Canada (production)	130	
United Kingdon (production)	700	
British Dependent Territories (exports)	2,541	
Australia (exports)		
Union of South Africa (exports)		
	3,371	
Estimated Requirements from Free Market		1,111

FRANCE, FRENCH OVERSEAS TERRITORIES and SAAR—	*Production*	*Consumption*	
Metropolitan France and Saar	1,536	1,370	
French Overseas Territories which do not import sugar—			
Martinique, Guadeloupe, Réunion, Madagascar	490	43	
French Overseas Territories which import sugar—			
Africa, excluding Algeria	—	120	
Algeria	—	217	
Other territories	—	5	
African Countries in the franc area which import sugar—			
Tunis	—	77	
Morocco	—	335	
	2,026	2,167	
Estimated requirements from free market			141
Carried forward			1,252

[1] *I.S.J.*, 1958, **60**, 153.

ESTIMATE OF FREE MARKET REQUIRMENTS FOR THE CALANDAR YEAR 1958—*continued*

Brought forward		1,252
COUNTRY OR AREA—		
EUROPE (excluding United Kingdom and France)—		
Austria	40	
Eire	25	
Finland	170	
Germany (West)	86	
Greece	95	
Iceland	9	
Italy	75	
Netherlands	190	
Norway	152	
Roumania	30	
Spain	150	
Sweden	40	
Switzerland	217	
Yugoslavia	10	
AMERICA—		1,289
Argentina	100	
Bolivia	20	
Chile	200	
Columbia	21	
Honduras	6	
Panama (Canal Zone)	2	
Uruguay	100	
AFRICA (other than British Commonwealth Countries and French Overseas Territories)—		449
Canary Island	8	
Egypt	65	
Liberia	1	
Libya	15	
Morocco (former Spanish Zone) and Tangiers	30	
Sudan	130	
ASIA (other than British Commonwealth Countries)		249
Afghanistan	23	
Burma	25	
China (Mainland)	175	
Iran	260	
Iraq	160	
Israel	60	
Japan	1,150	
Jordan	32	
Korea	60	
Lebanon	25	
Mongolia	6	
Pakistan	80	
Saudia Arabia and neighbouring Red Sea Territories	85	
Syria	50	
Thailand	10	
Vietnam, Cambodia and Laos	55	
OCEANIA (excluding New Zealand)	5	
		2,261
Allowances for possible underestimates and non-statistical consumption		5,500
		110
		5,610

BREVITIES

British Sugar Corporation Incentive Agreement.—The Minister of Agriculture, Fisheries & Food and the Secretary of State for Scotland have made an order, with the approval of the Treasury, under Section 19 of the Sugar Act, 1956, directing that effect shall be given to an Incentive Agreement with the Corporation. In accordance with the Sugar Act the Agreement provides for annual assessment of the results of the Corporation's undertaking in relation to standards of economy and efficiency in sugar extraction and other operations prescribed in the Agreement, and for incentive payments to be made to the Corporation, or deficiency payments to be made by the Corporation, according as the Corporation's results exceed or fall short of the standards prescribed.

Denmark Factory Proposal.[1]—A Committee is examining the conditions for construction of a sugar factory in Eastern Zealand, whereby new employment possibilities would be created there. The factory is to be constructed on a cooperative basis.

* * *

Madagascar Production.[2]—Despite unfavourable climatic conditions the 1957/58 crop amounted to 56,000 tons, whilst consumption amounted to some 24,000 tons. It is understood that Fiji disease which in the past had caused substantial losses, is rapidly being eradicated due to the combined efforts of the agricultural service and the growers.

[1] *Zeitsch. Zuckerind.*, 1958, **83**, 198.
[2] C. Czarnikow Ltd., *Sugar Review*, 1958, (358), 104.

BREVITIES

Sugar Factory for Ghana.[1]—A recently incorporated company is said to have been investigating the acquisition of land in the Tsito area, with a view to establishing a sugar factory and growing sugar cane on a large scale.

* * *

New Factories for Pakistan.[2]—The Pakistan Industrial Development Corporation is reported to have placed a series of orders, including some for sugar factories. One report is that an order has been placed with Mainland China and another that two factories near Hathian and Khanpur, each to produce 15,000 tons of white sugar per year, are to be built by a Dutch firm, at a cost of 32 million rupees. (£2,400,000).

* * *

The Late Arthur F. Bell.—We regret to report the sudden death, on 15th May, of ARTHUR F. BELL, Under-Secretary of the Queensland Department of Agriculture and Stock. He was well-known in the sugar industry from 1924 when he won a travelling sugar research scholarship. In 1928 he was appointed Pathologist to the Bureau of Sugar Experiment Stations of which he became Assistant Director in 1935 and Director in 1945. He resigned in 1947 on his appointment as Under-Secretary. He was a Past-President of the Queensland Society of Sugar Cane Technologists, and Chairman of the I.S.S.C.T. Committee on Sugar Cane Diseases.

Stock Exchange Quotations

CLOSING MIDDLE

London Stocks (*at 18th June* 1958)

Anglo-Ceylon (5s)	11/1½
Antigua Sugar Factory (£1)	20/9
Booker Bros. (10s)	20/–
British Sugar Corp. (Ltd. (£1)	15/3
Caroni Ord. (2s)	4/1½
Caroni 6% Cum. Pref. (£1)	17/–
Distillers Co. Ltd. (6s. 8d units)	23/4½
Gledhow Chaka's Kraal (£1)	55/–
Hulett & Sons (£1)	65/6
Jamaica Sugar Estates Ltd. (5s units)	5/7½
Leach's Argentine (10s units)	9/9
Reynolds Bros. (£1)	45/6
St. Kitts (London) Ltd. (£1)	49/6
Ste. Madeleine (Ord.) (£1)	25/9
Sena Sugar Estates (10s)	21/3
Tate & Lyle (£1)	53/3
Tate & Lyle Investments Ltd. (5s)	11/1⅓
Trinidad Sugar (5s stock units)	10/6
United Molasses (10s stock units)	29/9
West Indies Sugar Co. Ltd. (£1)	28/–

CLOSING MIDDLE

New York Stocks (*at 17th June* 1958)

	$
American Crystal ($10)	35½
Amer. Sugar Ref. Co. ($100)	29⅜
Central Aguirre ($5)	20
Cuban American ($10)	25⅛
Great Western Sugar	25⅛
South P.R. Sugar	27
United Fruit Co.	48⅞
West Indies Sugar Corp. ($1)	59¼

Coating Extender Derived from Sucrose.[3]—Commercial production of sucrose acetate iso-butyrate, known as SAIB, was begun in April 1958 as a result of work that has been done by Eastman Chemical Products Co., a subsidiary of Eastman Kodak. This company has been exploring the possibilities of sugar as an industrial raw material and has prepared many sucrose derivatives of which SAIB shows early commercial promise. It is formed by esterification of sucrose with acetic anhydride and iso-butyric anhydride and is an extremely viscous clear liquid of high molecular weight with excellent stability and wide compatibility with most resins, film formers and plasticizers. Incorporated into coating formulations its behaviour is intermediate between that of a resin and a plasticizer. The Company plans to market its new product as SAIB-90, a solution consisting of 10 parts of ethyl alcohol and 90 parts of sucrose acetate iso-butyrate. It may be used to extend and improve wood lacquers, paper coatings, cloth coatings, metal and plastic lacquers, hot melt coatings and peelable plastic coatings.

* * *

Sugar in East Germany.[4]—Statistics quoted from an article by the Minister of Food and Agriculture include the following:

	1958/59 Target	1957/58	1956/57
Beet area (hectares)	227,000	219,800	217,241
Beet worked for sugar (metric tons)	6,450,000	6,200,000*	3,996,000
Sugar production			
(metric tons refined value)	828,000	767,000	438,000
(metric tons, raw value)	920,000	852,222	486,667
Beet yield			
(metric tons/hectare)	28·41	27·89	18·39
Sugar extraction			
(%, raw value)	14·26	13·90	12·70
Sugar yield per hectare			
(metric tons, raw value)	4·05	3·88	2·24

* Includes 58,000 tons of beet worked for pulp and 12,000 tons for syrup.

The sugar and starch industry and the central laboratory for the sugar and starch industry have joined into an Association of People-owned Works of Sugar and Starch Industries. On 28th May, the rationing of sugar was lifted. The price is now 1·80 East German marks per kilo against the previous 1·08 marks.

* * *

Venezuela Sugar Exports.[5]—Exports from Venezuela in 1957 were more than trebled compared with the previous year. Details include the following:

Destination:	1957	1956
Italy	3,256	3,391
France	25,047	—
French Morocco	6,122	3,718
Holland	9,678	4,647
Switzerland	1,354	5,018
Greece	12,039	10,236
Belgium	6,377	—
U.K.	9,274	—
Colombia	20,179	—
U.S.A.	1,352	—
Libya	2,024	—
Malta	2,697	—
Israel	5,182	—
Roumania	—	4,200
Other Countries	812	144
	105,393	31,354

[1] *Overseas Review* (Barclays D.C. & O.), May 1958, 64.
[2] F. O. LICHT, *International Sugar Report*, 1958, **90**, (5), 12.
[3] *Sugar y Azucar*, 1958, **53**, (6), 25.
[4] F. O. LICHT, *International Sugar Report*, 1958, **90**, (5), 4–5.
[5] F. O. LICHT, *International Sugar Report*, 1958, **90**, (5), 11.